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BIOLOGY AND MEDICINE

2571 UCRL-3203

California. Univ., Berkeley. Radiation Lab.
 BEHAVIOR: IMBALANCE IN A NETWORK OF CHEMICAL
 TRANSFORMATIONS. Dan F. Bradley and M. Calvin.
 Oct. 12, 1955. 29p. Contract W-7405-eng-48.

A simple chemical system in a fixed environment tends to reach a state of chemical balance in which rates of reactions and concentrations of components in the system do not change with time. A sudden change in the environment destroys this balance, resulting in transient changes in the rates of reactions and concentrations of components within the system. Such transients are gradually damped out and the system tends to a new stationary state. The responses of mathematical models of a number of simple chemical systems to environmental changes, and the life-like appearance of these responses, are examined. Experimental methods of measuring such behavior in chemical systems and the use of this information in determining the network of chemical transformations within the system are investigated. The application of these general methods to determination of the network of chemical reactions in a living plant cell is reviewed. The close relationship between the observed behavior of the living photosynthesizing plant cell to sudden changes in environment and the behavior to be expected on the basis of the chemical network within the cell is demonstrated. (auth)

2572 UCRL-3228

California. Univ., Berkeley. Radiation Lab.
 AN APPARATUS FOR MEASURING HUMAN BODY
 VOLUME. William E. Siri. Dec. 9, 1955. 33p. Con-
 tract W-7405-eng-48. \$6.30(ph OTS); \$3.00(mf OTS).

The mean density, or alternatively the volume, of a human body is essential to in vivo estimates of body fat, protein, and mineral. A new method and apparatus for measuring body volume, based in principle on gas dilution, was developed to circumvent the disadvantages in applying Archimedes' principle to human subjects. The apparatus consists of two connected chambers forming a closed system. The larger chamber contains the subject in an air atmosphere while the smaller contains pure helium. Since the quantity of air in the system is inversely proportional to the subject's volume, the helium concentration, after the two gases are mixed, is an accurate measure of body volume. With corrections for thermal and respiratory gas effects, a high order of reproducibility was demonstrated by a variety of tests. The probable error in a single volume determination is estimated from tests and analysis to be 0.13 liter. (auth)

2573

THE GAMMA-RAY SPECTRUM OF NORMAL HUMAN
 BEINGS. C. E. Miller and L. D. Marinelli (Argonne
 National Lab., Lemont, Ill.). *Radiology* 66, 104-5(1956) Jan.

The gamma-ray scintillation spectra of 20 normal healthy human beings were obtained with a NaI crystal in a low-

level background room. A typical 70-kg man was found to have a body burden of about 10^{-7} μ c of β activity and 10^{-8} μ c of gamma activity. A procedure is described for measuring trace amounts of gamma emitters. The pure K^{40} spectrum is determined for the individual in question, a known amount of K^{42} is administered, and the difference between the actual spectrum and the normalized K^{42} spectrum is identified with the spectrum of any additional isotope present. (C.H.)

RADIATION EFFECTS,

2574 AECU-3130

Kansas. Univ., Lawrence.
 GENETIC RESISTANCE TO X-IRRADIATION IN MICE.
 Harold D. Swanson, C. A. Leone, and J. A. Weir. [1955].
 15p. Contract AT(11-1)-304.

A comparison was made of the effects of x-irradiation on mice of the high leucocyte count strain, LCH (15,000 cells/mm³) and low leucocyte count strains, LCL (5,000 cells/mm³). Among 30-day old mice, the LCH strain had a significantly lower mortality after irradiation, but in five-month old mice there was no difference between strains. Weight changes after irradiation do not differ between strains, in either age group. Leucocyte counts of both strains drop to the same level (400 cells/mm³) several days after irradiation. Mortality, changes in leucocyte count, and changes in weight seem to be independent. Total counts of circulating leucocytes, alone, do not provide a reliable index of resistance to irradiation, but greater hematopoietic activity in the LCH strain may aid survival. (auth)

2575 AECU-3133

Kansas. Univ., Lawrence.
 EFFECTS OF X-IRRADIATION ON THE PLASMAS OF
 CHICKENS AS REVEALED BY SEROLOGICAL ANALYSIS.
 PART I. WHOLE PLASMA COMPARISONS; PART II.
 ALTERATION OF PROTEINS OF THE LIVER; (A Prelimi-
 nary Report); PART III. AUTOANTIBODY FORMATION,
 (A Preliminary Report). Charles A. Leone. [1955]. 41p.
 Contract AT(11-1)-304.

Post-irradiation changes are described which were observed in the serological activity of plasma from x irradiated chickens. Antisera produced in rabbits against normal plasmas of chickens were able to distinguish plasmas from birds which had received 600 and 990r. The principal radioinduced changes seemed to occur in the β globulins of the plasma. An attempt is described to serologically examine proteins from various cytoplasmic constituents of liver cells from chickens in the hope of detecting modified metabolic pathways. Indifferent results were obtained. The influence of plasmas from x-irradiated and normal chickens on the growth of tissue culture preparations from embryonic chick heart and liver was studied. No conclusive evidence was obtained for the presence of autoantibodies or other specific inhibiting substances in the plasmas of the irradiated birds. (C.H.)

2576 AECU-3134

Kansas. Univ., Lawrence.

SOME EFFECTS OF IRRADIATION ON THE IMMUNOCHEMICAL AND PHYSICO-CHEMICAL IDENTITY OF SERUM PROTEINS OF RATS. Frank Dolyak. [1955]. 60p. Contract AT(11-1)-304.

That body proteins may be altered by irradiation to such an extent as to react as foreign elements and perhaps antagonists in their own physiological environment is postulated. The plausibility of this concept was examined. The serological activity of hemocyanins isolated from the sera of the American lobster, as measured by the quantitative, turbidimetric precipitin reaction, was found to be altered by *in vitro* x irradiation. Beta particles from internally deposited P^{32} produced chronic changes in the specificity of some proteins of rat serum, and quantitative changes were observed in the serum albumin and globulin of x-irradiated animals. Increased concentrations of these components in the sera of normal animals produced reactions similar to serological reactions. 56 references. (C.H.)

2577 HW-30119

Hanford Atomic Products Operation, Richland, Wash. A COMPARATIVE STUDY OF HANFORD AND UTAH RANGE SHEEP. L. K. Bustad, S. Marks, N. L. Dockum, D. R. Kalkwarf, and H. A. Kornberg. Nov. 30, 1953. 44p. Contract [W-31-109-Eng-52].

Observations on sheep representing flocks in Utah adjacent to the Nevada Proving Ground were compared with findings made on experimental sheep exposed to various amounts of radioiodine. The Utah sheep showed no evidence of the radiation damage observed in experimentally treated sheep. Estimations of amounts of radioiodine on vegetation required to cause serious thyroid damage following a contamination event are included. (auth)

2578 MLM-761

Mound Lab., Miamisburg, Ohio.

HISTOPATHOLOGICAL STUDY OF SPRAGUE-DAWLEY RATS INJECTED INTRAVENOUSLY WITH VARYING AMOUNTS OF POLONIUM. R. N. Cowden and Robert E. Zipf. Apr. 1, 1952. Decl. Oct. 17, 1955. 62p. Contract AT-33-1-GEN-53.

Sprague-Dawley rats in dosage levels of 35, 23, 8, 3.6, and 0.9 μC of Po/kg of body weight were serially sacrificed with the last sacrifices at 375 days post injection. The organs most susceptible to the ionizing radiations of Po were the kidneys, gonads, lymphoid tissue, and blood. On all irradiation levels, the kidneys showed consistent degenerative changes. The lesions involved primarily the proximal convoluted tubules. The first kidney damages were detected 100 days post injection and were slowly progressive. The gonads showed early atrophy and hypoplasia of germinal cells. The ovaries showed progressive degenerative change on all dosage levels, while the testes showed an initial degeneration of the germinal cells followed by partial or complete recovery of the maturation processes of the spermatogenic cells in the lower dosage levels. The spleen and both the solitary and aggregate lymph follicles revealed early hypoplasia of cellular elements with recovery to normal lymphopoiesis on the lower injection levels. The effects of Po on the blood will be described in another report. The lungs and stomach showed hemorrhage on the 35 and 23 μC levels. The heart and thyroid showed degenerative changes late in the experiment on the lower injection levels. (auth)

2579 TID-8002

Technical Information Service, AEC.

FACILITY DESIGN UTILIZING GAMMA RADIATION FOR MEAT PASTEURIZATION. L. E. Brownell, J. J. Bulmer, and J. V. Nehemias, Fission Products Lab., Univ. of Michigan. Jan. 1956. 13p. \$0.20 (OTS).

One of its monograph series "The Industrial Atom."

The design of a γ radiation facility for treating commercial quantities of fresh meat is presented. Such a unit would consist of a radiation source, a radiation chamber, a conveyor system, and sufficient shielding material to permit routine operation with no hazard to personnel. Cost estimates and a cutaway perspective view of the proposed design are included. (C.H.)

2580

FURTHER STUDIES OF EFFECTS OF X-RADIATION ON PARTIALLY SHIELDED LENS OF RABBIT. P. J. Leinfelder and E. F. Riley (State Univ. of Iowa, Iowa City). *Arch. Ophthalmol.* 55, 84-6(1956) Jan.

Doses of x-radiation as high as 12,000 r produced only partial cataract in the exposed quadrant of the rabbit lens when two or three of the lens quadrants were shielded from the radiation. (auth)

2581

PEPSIN DIGESTION OF SERUM ALBUMIN IRRADIATED BY γ RAYS. Ya. A. Epshtein and E. A. Zabozaeva. *Biokhimiya*, 20, 701-5(1955) Nov.-Dec. (In Russian)

An investigation of γ -ray effects on serum albumins was made to determine the products of albumin peptolitic fractionation. The results proved that γ radiation accelerates pepsin digestion of serum albumin. Also, a much quicker formation of fractions easily absorbed by the basic anions and some not so easily absorbed were observed during the peptolyses. The acceleration of serum albumin peptolyses depends upon the intensity and the time length of radiation and is affected by denaturation of the albumin molecules. (R.V.J.)

2582

ON CERTAIN BIOLOGICAL EFFECTS OF PENETRATING RADIATION. S. E. Mononilov and K. P. Ivanov (Kalinin State Medical Inst.). *Doklady Akad. Nauk. S.S.S.R.* 105, 180-1(1955) Nov. 1. (In Russian)

Aerobic phases of biological oxidation in tissues exposed to radiation were investigated. Isolated frog hearts were analyzed and the electrocardiographs are given. (R.V.J.)

2583

DEGENERATION OF SPERMATOGONIA OF THE MOUSE FOLLOWING EXPOSURE TO X RAYS, AND STAGES IN THE MITOTIC CYCLE AT WHICH CELL DEATH OCCURS. Eugene F. Oakberg (Oak Ridge National Lab., Tenn.). *J. Morphol.* 97, 39-54(1955) July.

2584

RADIATION SENSITIVITY OF OVARIAN TISSUE AT -79°C . A. S. Parkes (National Inst. for Medical Research, London). *Nature* 176, 1216-17(1955) Dec. 24.

Experimental results indicate that low temperatures reduce radiation damage in rat ovarian tissue. (C.W.H.)

2585

THE EFFECT OF OXYGEN ON THE RADIOSENSITIVITY OF MAMMALIAN CELLS. Alan D. Conger (Oak Ridge National Lab., Tenn.). *Radiology* 66, 63-9(1956) Jan.

The effect of oxygen concentration on the radiosensitivity of mammalian cells was investigated, using Ehrlich mouse

ascites tumor as the test cells. Data are presented on the cytological abnormality of the cells growing in vivo after x irradiation in vivo in nitrogen, air, and oxygen; the cytological abnormality, at time of minimum normalcy, as a function of in vitro x-ray dose in nitrogen, air, and oxygen; and the effect of oxygen concentration on the radio-sensitivity of ascites tumor cells irradiated in vitro with x rays and with fast neutrons. Results show a close correlation with results from previous studies on the radio-sensitivity of Vicia root tips and Tradescantia pollen grains as a function of oxygen concentration. (C.H.)

2586

LIMITATIONS OF THE CONCEPT OF LINEAR ENERGY TRANSFER (LET). H. H. Rossi and W. Rosenzweig (Columbia Univ., New York). Radiology 66, 105(1956) Jan.

Factors are discussed which affect variations in results of measurements of the relative biological effectiveness of ionizing radiation. (C.H.)

2587

PRONUCLEAR FUSION AS AFFECTED BY X-RAYS AND BY POSTIRRADIATION ANAEROBIOSIS. C. S. Bachofer (Univ. of Notre Dame, Ind.). Science 123, 139-40(1956) Jan. 27.

Observations are presented on the effect of x rays on the rate of pronuclear fusion in the eggs of *Ascaris*. Modifications in effects produced by postirradiation anaerobiosis are described. (C.H.)

2588

THE EFFECT OF SMALL DOSES OF X RADIATION ON ASCITES TUMORS OF THE MOUSE AND THEIR PREVENTION. Franz Falk (Univ. of Heidelberg, Germany). Strahlentherapie 98, 518-42(1955) Dec. (In German)

Male albino mice were subjected to diffuse roentgen irradiation of 10 r. The basophil cells of spleen and thymus multiplied considerably from the 2nd to the 4th day. Other mice, which had been vaccinated with the liquid of tumor-ascites, received the same dose of x rays. From the 3rd to the 9th day an immense multiplication of the basophil cells in both organs could be remarked. The lives of x-rayed tumor-bearing animals were prolonged by 5 to 10 days. (auth)

2589

OBSERVATIONS ON RADIATION CANCERS. A. Beutel and F. Skopal (Dortmund City Hospital, Germany). Strahlentherapie 98, 570-5(1955) Dec. (In German)

Observations have shown that the maximum interval between the first irradiation and the appearance of cancer stretches over 35 yr. In special cases a roentgen-treatment of the radiogene carcinoma is justified. In most cases the so-called radiogene cancer is a defect caused by wrong combination; each case, therefore, must be strictly analysed. The development of cancer on sound skin is extremely infrequent; according to observations, first symptoms of a carcinoma could be stated 6 yr after a post-irradiation after Wertheim. In case of an accordingly long development, the so-called radiogene carcinoma may pass the limits of the irradiation field; it may spare the sound skin and provoke its rapid protrusive spreading. (auth)

2590

FURTHER RESULTS ON MUTATION RESEARCH. Hans

Breider (Wurzberg, Germany). Strahlentherapie 98, 616-27(1955) Dec. (In German)

An accumulated report on the most recent problems of research in mutation is presented. The following problems are considered: gene-environment-characteristic; judgement of a mutation from the viewpoint of the practitioner in genetics; judgement of a mutation from the viewpoint of the theorist in genetics; radiogenetics and human genetics; radiation dose and natural rate of mutation; atomic rays; somatic mutations, and inactivated as well as reactivated genes. (auth)

2591

DEVELOPMENT OF AN UNSEGMENTED SALAMANDER EMBRYO AFTER TREATMENT WITH X RADIATION IN COMBINATION WITH OXYGEN DEFICIENCY, COLD, AND HYDROCYANIC ACID. Theofried Peters (Heiligenberg Inst., Heiligenberg-Bodensee, Germany). Strahlentherapie 98, 628-39(1955) Dec. (In German)

RADIATION HAZARDS AND PROTECTION

2592 NRL-4607

Naval Research Lab., Washington, D. C.
RELATIONSHIP BETWEEN THE AIR CONCENTRATION OF RADIOACTIVE FISSION PRODUCTS AND FALLOUT. Interim Report. I. H. Blifford, Jr., L. B. Lockhart, Jr., and R. A. Baus. Aug. 20, 1955. 10p. Project NR-612-130.

Comparative data on the daily concentration of fission products in the air and the actual fallout on the ground have been collected. For short times after a test, fallout was very much dependent on rainfall. In many cases, the air concentration was affected relatively little. On the average, the apparent rate of fallout was about 4×10^4 ft/day. Screens made of cloth or metal mounted on a vane and exposed to the wind were efficient collectors of fission products dispersed in the atmosphere. In some cases, 10 to 100 times as much activity was deposited on a vertical screen as on an equal horizontal area. No definite correlation between gummed-paper, screen, and filter collections has been noted. Direct interception by the small fibers of vegetation, as distinguished from simple fallout, may account for a large fraction of the total fission product activity adsorbed on such ground cover. Additional measurements were made on the distribution of activity with particle size by the use of filter media of different retention characteristics. (auth)

2593 NYO-4654

Harvard Univ., Cambridge, Mass.
SANITARY ENGINEERING ASPECTS OF LONG-RANGE FALLOUT FROM NUCLEAR DETONATIONS (thesis). Carlos G. Bell, Jr. Jan. 1955. 248p. Contract AT(30-1)-841.

Samples of surface water, rain water, stream mud, and soil were collected in Eastern Massachusetts from March to July, 1953, and assayed for radioactivity. Fall-out activity measurements were also obtained on samples from other areas of Massachusetts and the vicinity of Rochester, N. Y. Plots are presented showing the relationship of the radiological data to the timing of detonations and the daily precipitation. Daily deposition of activity and concentration in runoff are tabulated. Run-off coefficients for fallout radioactivity are calculated.

Variability of decay rates with the nature of the sample and the time of collection indicate some fractionation of the fission products in nature. Low decay rates of fall-out deposited during the 1953 tornado suggest the tornado scavenged high altitude debris from the Nov. 1952 Operation Ivy. Rapid sand filter water treatment plants in the study area removed between 10 and 55% of the fall-out radioactivity, the higher efficiency occurring soon after a detonation and diminishing with time. (C.H.)

2594

PROTECTION BY SPLEEN HOMOGENATES AGAINST β -RAY-INDUCED SKIN INJURY IN RATS. Georges Ungar, Evelyn Damgaard, and Florence Williams (Univ. of Illinois Coll. of Medicine, Chicago). J. Appl. Physiol. **8**, 287-8 (1955) Nov.

Treatment with spleen homogenates was found to protect rats against β -ray-induced skin injury. In the spleen-treated group damage occurred later, was less marked and the over-all incidence was significantly lower than in the controls. (auth)

2595

EFFECTS OF LOW-LEVEL RADIOACTIVITY IN THE COLUMBIA RIVER. Croswell Henderson, Gordon G. Robeck, and Ralph C. Palange. Public Health Repts. (U. S.) **71**, 6-14 (1956) Jan.

A survey was made of the water quality characteristics of the Columbia River prior to impoundment and the effects of radioactivity on the physical, chemical, and biological characteristics of the stream below the Hanford site. Results are summarized and are correlated with the continuous monitoring and research activities of the General Electric Co. at the Hanford Works. The studies provide data which can be used to establish objectives for comprehensive water pollution control programs. (C.H.)

2596

PUBLIC HEALTH ASPECTS OF ATOMIC ENERGY IN PEACETIME. Daniel Bergsma. Public Health Repts. (U. S.) **71**, 43-6 (1956) Jan.

Public health problems are reviewed which may arise under conditions of the peacetime use of radioactive materials. (C.H.)

2597

MEDICAL AND INDUSTRIAL RADIUM AND THORIUM INJURIES. A. Gebauer and R. Heincker (Univ. of Frankfurt (Main), Germany). Strahlentherapie **98**, 558-69 (1955) Dec. (In German)

Five sick persons suffering from heavy defects in the reticulo-endothelial system, which had appeared 10 to 15 yr after thorotrast injection were studied. One of the patients fell ill of a leucosis. All patients complained temporarily of pain in the epigastric regions, which is linked with the occasionally observed increased porphyrinuria. A chemist who, in his professional work, had to handle radium and mesothorium fell ill of a pneumo-fibro fibrosis leading to death. These observations underline the danger in employing radioactive material. (auth)

RADIATION SICKNESS

2598

THE PATHOGENESIS OF THE HEMORRHAGIC STATE IN RADIATION SICKNESS: A REVIEW. A. C. Upton (Oak Ridge National Lab., Tenn.). Blood **10**, 1156-63 (1955) Nov.

RADIOGRAPHY

2599

POSSIBILITY OF USING THULIUM 170 AS A TELERADIOGRAPHIC SOURCE FOR LOCALIZATION PURPOSES IN TELETHERAPY WITH COBALT 60. Warren K. Sinclair and Betsy J. Smith (Univ. of Texas M. D. Anderson Hospital and Tumor Inst., Houston). Radiology **66**, 104 (1956) Jan.

Uses of Tm^{170} as a radiographic source for internal radiography and for use in teleradiographic units are reviewed briefly. It is suggested that Tm^{170} might prove of value as a teleradiographic source for localization in teletherapy with Co^{60} . (C.H.)

RADIOTHERAPY

2600

EFFECTS OF RADIOPHOSPHORUS AND CORTISONE ON TRANSPLANTED MAMMARY ADENOCARCINOMAS IN SUSCEPTIBLE AND RESISTANT MICE. Norman E. Boucher, Jr., Jerome T. Syverton, and John J. Bittner (Univ. of Minnesota, Minneapolis). Cancer Research **16**, 22-31 (1956) Jan.

Pretreatment with P^{32} and cortisone in combination was found to enhance the development of implanted homologous tumor tissue in susceptible mice. Pretreatment with either P^{32} or cortisone alone failed to elicit the enhance effect obtained with these agents in combination. (C.H.)

2601

AN EVALUATION OF VARIOUS FACTORS INFLUENCING THE TREATMENT OF METASTATIC THYROID CARCINOMA WITH I^{131} . Farahe Maloof, Austin L. Vickery, and Betty Rapp (Harvard Medical School and Massachusetts General Hospital, Boston). J. Clin. Endocrinol. and Metabolism **16**, 1-27 (1956) Jan.

Total thyroidectomy and the administration of the anti-thyroid drugs are effective in inducing or increasing an uptake of I^{131} in the metastases of patients with thyroid carcinoma. However, this effect may be outweighed by the concomitant growth stimulus imparted to the metastases. Functional and histologic variations in metastases of the same patient may defeat the attempt of the physician to treat thyroid carcinoma successfully with I^{131} . General bodily complications resulting from the administration of total doses of from 70 to 2,000 mc of I^{131} over periods of one to eight years have not as yet been limiting factors in treatment with this isotope. Desiccated thyroid, but not testosterone, appears to be of value in controlling the growth of thyroid metastases which have been sensitive to I^{131} treatment. (auth)

2602

CONTAMINANT DOSE FROM INCIDENT NEUTRONS ASSOCIATED WITH 22.5-MEV X-RAYS FROM A BETA-TRON. W. Ernst and J. Ovadia (Sloan-Kettering Inst., New York). Radiology **66**, 105-6 (1956) Jan.

Procedures are discussed for calculating the fast neutron dose in tissue from 22.5-Mev x rays from a betatron. (C.H.)

2603

SOME PHYSICAL CONSIDERATIONS GOVERNING THE CHOICE OF INTERNALLY ADMINISTERED RADIOISOTOPES FOR THERAPY. M. Berman, J. E. Rall, and

J. Heslin (Sloan-Kettering Inst., New York). Radiology 66, 106(1956) Jan.

Factors governing the choice of internally administered radioisotopes for therapeutic uses are discussed. Calculations indicate that I^{131} is not always the most desirable for maximal tumor and minimal critical region irradiation. (C.H.)

2604

PRESENT RESULTS ON THE BIOLOGICAL EFFECT OF ULTRAFRACTIONATED RADIATION. II. COMMUNICATION ON THE BEHAVIOR OF PROTRACTION FACTORS IN ULTRAFRACTIONATED RADIATION. D. Hofmann (Univ. of Gottingen, Germany). Strahlentherapie 98, 552-7(1955) Dec. (In German)

The behavior of the protraction factors in experiments with an ultra-fractionized Sr^{90} β radiation and ultra-fractionized roentgen radiation are studied. Relative to the maximum dose intensity to be reached each time, protraction factors were found which proved to be < 1 in the case of the Sr radiation and > 1 in the case of the roentgen radiation. (auth)

TOXICOLOGY STUDIES

2605 AEC-tr-2368

IODIZED CARBON AS PROTECTION AGAINST MERCURY POISONING. Alfred Stock. Translated from Z. Angew. Chem. 47, 64(1934). 3p.

Activated carbon saturated with 5% iodine was determined to be a good absorption agent for mercury vapors and to offer a valuable protection against mercury vapor poisoning. Iodized carbon gas masks were found to afford protection for workers in industries where high concentrations of Hg fog occur in the atmosphere. Iodized carbon also was found to render good service in the form of dusting carbon for the treatment of floors, tables, and cracks contaminated with Hg dust. (C.H.)

TRACER APPLICATIONS

2606

AUGMENTATION OF PROLACTIN ACTIVITY BY I^{131} . Sheldon J. Segal and Emil Witschi (State Univ. of Iowa, Iowa City). Anat. Record 120, 772-3(1954) Nov.

2607

DESOXYPENTOSE NUCLEIC ACID SYNTHESIS DURING MICROSPOROGENESIS IN TRADESCANTIA. M. J. Moses (Brookhaven National Lab., Upton, N. Y.) and J. H. Taylor (Columbia Univ., New York). Exptl. Cell Research 9, 474-88(1955) Dec.

DNA- P^{32} incorporation and DNA content of nuclei in various stages of *Tradescantia* microsporogenesis were determined by means of autoradiographs and cytophotometric measurements of the Feulgen reaction. The DNA content was found to follow that predicted on the basis of the constancy hypothesis. P^{32} was incorporated in the DNA fraction only during those periods when the DNA content was in the process of doubling. DNA synthesis occurs at different specific periods characteristic for each of the succeeding sporogenic divisions: early prophase of the first meiotic division, late interphase of the microspore

division and mid-interphase of the pollen division. There can thus be no generalized period in the division cycle when DNA synthesis occurs; it seems to depend on the nature of the division. From correlations with published x-ray breakage data, it appears that completion of DNA synthesis occurs about the time chromosomes first behave as double entities to x-rays. (auth)

2608

EFFECT OF X-RAYS ON TRACE-LABELED I^{131} INSULIN AND ITS RELEVANCE TO BIOLOGIC STUDIES WITH I^{131} -LABELED PROTEINS. Rosalyn S. Yalow and Solomon A. Berson (V. A. Hospital, Bronx, N. Y.). Radiology 66, 106(1956) Jan.

2609

FATE OF RADIOSTRONTIUM FED TO HABROBRACON FEMALES. Daniel S. Grosch and Leo E. LaChance (Marine Biological Lab., Woods Hole, Mass.). Science 123, 141-2(1956) Jan. 27.

Results are summarized from a study of the tissue distribution of Sr in *Habrobracon* females following feeding with honey labeled with Sr^{90} . Data are included on biological half-life, proportionate gross tissue distribution, and on egg radioactivity. (C.H.)

WASTE DISPOSAL

2610 WASH-275

Division of Reactor Development, AEC. SANITARY ENGINEERING CONFERENCE, BALTIMORE, MARYLAND, APRIL 15-16, 1954. Aug. 1955. 332p.

Twenty-six papers on various phases of sanitary engineering are included in this report. The results of radioactive waste-disposal operating and research activities at various AEC and contractor installations are presented and reviewed. (cf. WASH-129.) (C.H.)

CHEMISTRY

2611 CCC-1024-TR-162

Callery Chemical Co., Penna. PREPARATION AND ANALYSIS OF CALIBRATION GASES FOR BORANE MONITORING DEVICES. L. J. Kuhns, R. H. Forsyth, and J. L. Eakin. Dec. 5, 1955. 13p. Contract [NOa(s) 52-1024-c].

Procedures are presented for the determination of trace quantities of boranes (diborane, pentaborane, triethyl borane, decaborane, and dimethoxyborane) in air. Decaborane was determined by the Hill quinoline method while the other boranes were determined by the boric acid-dianthrime method. (C.W.H.)

2612 CCC-1024-TR-163

Callery Chemical Co., Penna. FLAMMABILITY LIMITS OF DIBORANE. D. K. Eads and C. A. Thomas. Dec. 8, 1955. 7p. Contract [NOa(s)-52-1024-c].

The flammability limits of diborane in dry CO_2 -air were measured. Concentrations from 0.9 to 98 mol % B_2H_6 were flammable, and a lower pressure limit was found at about 3 mm absolute and 15 mol % B_2H_6 . (auth)

2613 ERI-1966-1-P

Michigan. Univ., Ann Arbor. Engineering Research Inst.

CHEMISTRY OF BORON HYDRIDES AND RELATED HYDRIDES. Annual Report for 1953. Robert W. Parry, David H. Campbell, Donald R. Schultz, Sheldon G. Shore, Thomas C. Bisson, and Robert C. Taylor. May 1954. 84p. Project M966. Contract AF-33(616)-8. (AD-37021).

Investigations were continued on the reaction between Na and the diammoniate of diborane, metathesis reactions in liquid NH_3 , chemistry of NH_4BH_4 , reactions between alkyl-substituted hydroxylamines and diborane, physical properties of the hydroxylamines, and reactions of LiAlH_4 with phosphorus chlorides. (C.W.H.)

2614 HW-39945

Hanford Atomic Products Operation, Richland, Wash. SPONTANEOUS DECOMPOSITION OF TRICHLOROETHYLENE. G. F. Yost. Nov. 15, 1955. 5p. Contract W-31-109-Eng-52. \$1.80(ph OTS); \$1.80(mf OTS).

The potential hazards of using CCl_2CHCl for degreasing Al were investigated. Descriptive details of the chemical reactions and theory involved are presented, followed by recommendations for the prevention of spontaneous decomposition of CCl_2CHCl under normal operating conditions. (C.W.H.)

2615 LA-1431

Los Alamos Scientific Lab., N. Mex.

PREPARATION OF ANHYDROUS PLUTONIUM TRICHLORIDE. E. L. Christensen and L. J. Mullins. Oct. 15, 1952. Decl. Sept. 29, 1955. 8p. Contract W-7405-eng-36.

Some exploratory tests were made using hexachloropropene with various plutonium compounds as starting material. This led to a method of preparation of anhydrous PuCl_3 of 98% purity by heating hexachloropropene with Pu III oxalate at 180 to 190°C for 18 hours. By this method, 628.7 grams of the trichloride were prepared. (auth)

2616 NP-5861

Michigan. Univ., Ann Arbor.

BULLETIN OF UNPUBLISHED THERMAL DATA. Edgar F. Westrum, Jr., comp. Aug. 1955. 20p.

Thermodynamic data which have not appeared in the published literature are listed for several organic and inorganic compounds. (C.W.H.)

2617 RMO-2509

Rohm and Haas Co. Research Labs., Philadelphia.

ELECTROLYTIC REDUCTION OF COMMERCIAL PHOSPHORIC ACIDS. C. T. Dickert and P. F. Kirk. Aug. 27, 1952. Decl. Sept. 23, 1955. 20p. Contract AT(49-1)-535.

An electrolytic method was investigated for the reduction of commercial phosphoric acids prior to liquid-liquid extraction of uranium. This method was found capable of reducing the acids to the desired potential with very low power costs, a minimum of equipment and without the introduction of foreign metals. (auth)

2618 AEC-tr-2376

MECHANISM OF THE FORMATION OF NITROUS ACID FROM NITRIC ACID AND NITROGEN DIOXIDE. F. Lang, T. Magdalena, and J. Montaigne. Translated by K. S. Bevis from *Compt. rend.* 237, 714-15(1953). 3p.

Investigations of the oxidation of tetramethylbenzidine

in a weak aqueous solution of nitric acid, where $0.947 \text{ N} \leq [\text{HNO}_3] \leq 1.89 \text{ N}$, support the mechanism of the formation of HNO_2 by the action of NO_2 on HNO_3 . Results agree with those previously obtained. (auth)

2619 TT-571

OXIDATION OF HYDROGEN BY OXYGEN ATOMS. (Okislenie Vodoroda Atomarnym Kislorodom). M. M. Pavliuchenko. Translated by D. G. H. Marsden from *Zhur. Fiz. Khim.* 14, 877-85(1950). 17p.

The oxidation of hydrogen by oxygen atoms, produced by photo-dissociation of molecular oxygen, was investigated. It was concluded that the reaction proceeds by gas-phase reaction with metastable atoms; the collision efficiency is the same at liquid air and at room temperatures and the activation energy is zero. A surface reaction was also observed in the platinized vessel. (C.W.H.)

2620

ELECTROCONDUCTIVITY OF CONCENTRATED AQUEOUS SOLUTIONS OF LiCl , NaCl , AND KCl AT HIGH TEMPERATURES. I. M. Rodnyanski and I. S. Galinker. (Khar'kov V. V. Dokuchaev Agri. Inst.) *Doklady Akad. Nauk* 105, 115-18(1955) Nov. 1. (In Russian)

Investigations of electroconductivity of 1 to 3N salt solutions of LiCl , NaCl , and KCl up to 340°C are discussed, and tabulations are given. (R.V.J.)

2621

THERMAL DIFFUSION IN POLYMER SOLUTIONS. A. H. Emery, Jr. and H. G. Drickamer (Univ. of Illinois, Urbana). *J. Chem. Phys.* 23, 2252-7(1955) Dec.

Thermal diffusion measurements have been made on a series of organic solutions of polystyrene. The thermodynamic property $X\partial\mu/\partial X$ describes adequately the concentration dependence of the thermal diffusion ratio α . It appears that that portion of the motion of the polystyrene molecule in dilute and somewhat concentrated solutions which is segmental involves 10 to 13 chain atoms in the moving segment. (auth)

2622

THE VAPOR PRESSURE OF BROMINE FROM 24 TO 116°. Jack Fischer and James Bingle (Argonne National Lab., Lemont, Ill.). *J. Am. Chem. Soc.* 77, 6511-12(1955) Dec. 20.

The vapor pressure of Br_2 from 24 to 116°C is expressed by the equation, $\log p = -(2199.0/T) - 4.150 \log T + 19.9618$, where p = pressure in mm, and T = temperature in °K. (auth)

2623

HEATS OF FORMATION OF NIOBIUM CARBIDE AND ZIRCONIUM CARBIDE FROM COMBUSTION CALORIMETRY. Alla D. Mah and B. J. Boyle (U. S. Dept. of the Interior, Berkeley, Calif.). *J. Am. Chem. Soc.* 77, 6512-13(1955) Dec. 20.

The values obtained for the heats of formation of $\text{NbC}_{0.9445}$ and ZrC were -33.6 ± 0.8 and -44.1 ± 1.5 kcal/mol, respectively. (C.W.H.)

2624

ADSORPTION ISOTHERMS, ISOBARS AND ISOSTERES OF DIBORANE ON BORON NITRIDE AND PALLADIUM ON CHARCOAL. Harold C. Beachell and Harold S. Veloric (Univ. of Delaware, Newark). *J. Phys. Chem.* 60, 102-3(1956) Jan.

Adsorption isotherms, isobars, and isosteres of di-

borane on boron nitride and Pd on charcoal were obtained in the pressure range of 200 to 750 mm. and temperature range of 180 to 300°K. The sorption isotherms were found to be Langmuir, Type I, with negligible hysteresis even at the lowest temperatures. Fit of the Langmuir low pressure adsorption isotherm to the data was found in the case of Pd on charcoal. Calculations of the isosteric heat of adsorption as a function of the quantity of gas adsorbed were made. It was concluded that the adsorption process represents pure Van der Waals adsorption which fits the Langmuir hypothesis for low pressure adsorption. No evidence was found for chemisorption. (auth)

Refer also to abstract 2720.

ANALYTICAL PROCEDURES

2625 AECU-3131

Illinois. Univ., Urbana.

[OCCURRENCE OF TECHNETIUM IN NATURE]. Final Report for the Period November 1, 1954 to August 31, 1955. Edward Anders (Alperovitch). Sept. 1, 1955. 20p. Contract AT-(11-1)-67.

Twelve neutron activation analyses for naturally occurring Tc^{99} were performed. Positive results were obtained in ten cases. Precautions were taken to avoid interference by Mo and Tc^{99} . The cross section of the reaction $Tc^{99}(n,n')Tc^{99m}$ was found to be equal to 4 ± 2 mb for the neutron spectrum of the vertical thimbles of the Argonne CP-5 reactor. The chemical state of Mo(VI) in basic solution was studied by an anion-exchange technique. Evidence was obtained for the existence of polymeric species at pH values up to 14. Preliminary work on the stability of Dowex-1 anion exchange resin in perchlorate media indicates rapid deterioration even at 0.2F ClO_4^- . (auth)

2626 NP-5056(Del.)

NP-5057(Del.)

Tracerlab, Inc. Western Div., Berkeley, Calif. HANDBOOK OF RADIOCHEMICAL ANALYSIS. VOL. I. RADIOCHEMICAL TECHNIQUES. VOL. II. RADIOCHEMICAL PROCEDURES. L. J. Beaufait, Jr. and H. R. Lukens, Jr. (Vol. I. (NP-5056(Del.)), May 15, 1953. 151p. and Vol. II. (NP-5057(Del.)), Mar. 5, 1952. 140p.) Contract AF33(038)-14115.

These two volumes were issued separately but are cataloged as a unit.

Detailed information is presented on the radiochemical analysis of U, Np, Pu, and several fission products. Laboratory and counting techniques are described. (C.W.H.)

2627 NRL-4679

Naval Research Lab., Washington, D. C.

THE DETERMINATION OF ARSENIC IN STEEL BY X-RAY FLUORESCENCE. Martin B. Cavanagh. Nov. 25, 1955. 6p. Project No. WADC-53-203.

Trace quantities of As in stainless steel samples can be determined by x-ray analysis techniques. An acid sulfide precipitation is used to separate As from the bulk of the iron. The internal standard employed is Ge. This method is applicable to steel samples containing 0.1 to 1.0 mg arsenic. (C.W.H.)

2628 UCRL-3213

Calif. Univ., Berkeley. Radiation Lab.

A STUDY OF THE MECHANISM OF ELECTROREDUCTION AT THE DROPPING MERCURY ELECTRODE (thesis). Russell Hobart Sanborn. Dec. 1955. 78p. Contract W-7405-eng-48.

The polarographic method was used to study the kinetics and mechanism of the electroreduction of Ni^{2+} , Co^{2+} , and Fe^{2+} in aqueous solution. The reduction was studied as a function of temperature in a non-complexing media, in Cl solutions, and in the presence of agar. It was concluded that all three ions are reduced through the electron-transfer mechanism. The slow step in the reduction of Ni^{2+} and Co^{2+} is probably the introduction of the first electron to form the unipositive states, whereas the slow step in the reduction of Fe^{2+} is the simultaneous introduction of two electrons. The results are compared with other characteristics of the three ions. The reduction of Ni^{2+} at the dropping mercury electrode leads to the formation of Ni^+ where the concentration of various salts, such as $NaClO_4$, $LiClO_4$, $Ca(ClO_4)_2$, $NaCl$, or KCl , is made sufficiently high. In general the formation of Ni^+ becomes clearly evident at salt concentrations ($\sim 1M$) and becomes the principal process where the salt concentration is made 2 to 3M. Various experiments to characterize Ni^+ are described and some possible explanations of the phenomena are presented. (auth)

2629

KONZENTRIEREN ANORGANISCHER IONEN AUF PAPIER MITTELS ELEKTROPHORESE. (Concentration of Inorganic Ions by Means of Paper Electrophoresis). G. de Vries and E. Van Dalen (Vrije Universiteit, Amsterdam, Netherlands). *Anal. Chim. Acta* 13, 554-61 (1955) Dec.

The paper chromatographic determinations of Cd^{2+} , Co^{2+} , Cr^{3+} , Mn^{2+} , Ni^{2+} , Pb^{2+} , Ti^{4+} , UO_2^{2+} , U_6^{4+} , Fe^{3+} , Ag^+ , AuO_2^{3-} , BO_3^- , Br^- , I^- , MoO_4^{2-} , VO_3^- have been improved by pre-concentration of the ions by electrophoresis. (C.W.H.)

2630

THE DETERMINATION OF SUB-MICROGRAM QUANTITIES OF SODIUM IN LITHIUM METAL BY RADIOACTIVATION. A. A. Smales and B. A. Loveridge (Atomic Energy Research Establishment, Harwell, Berks, England). *Anal. Chim. Acta* 13, 566-73 (1955) Dec.

Sub-microgram quantities of Na in Li metal may be estimated by an activation-analysis method based on the $Na^{23}(n,\gamma)Na^{24}$ reaction. The lower limit of detection is 3×10^{-10} grams Na. (C.W.H.)

2631

LEACHING OF SOME FISSION PRODUCTS FROM SOIL. Bernd Kahn (Oak Ridge National Lab., Tenn.). *Anal. Chem.* 28, 216-18 (1956) Feb.

A simple procedure permits the radiochemical determination of radionuclides of Cs, Sr, Y, Ce, Ru, Zr, and Nb adsorbed on soil; the procedure consists of leaching the radionuclides with appropriate volumes and concentrations of boiling HNO_3 , $H_2C_2O_4$, or H_2SO_4 , separation of the radionuclides from nonradioactive ions leached from the soil; and standard radiochemical separations. To determine the leaching efficiency of various solutions, radioactive tracers were adsorbed on Conasauga shale from aqueous solutions and then leached from the shale. It was found that 99% of the adsorbed radionuclides could be removed from

the soil by the leach solutions. By modifying existing radiochemical procedures, it was possible to remove the contaminating nonradioactive ions leached from the soil and thus obtain the radionuclides free of ions which could interfere with their radiochemical determination. (auth)

2632

NEUTRON ACTIVATION ANALYSIS WITH THE VAN DE GRAAFF ACCELERATOR. APPLICATION TO THE HALOGENS. George J. Atchison and William H. Beamer (Dow Chemical Co., Midland, Mich.). Anal. Chem. **28**, 237-43 (1956) Feb.

A rapid physical method of analysis for milligram quantities of F_2 and microgram quantities of the other halogens is based on neutron activation. The neutron source is the nuclear reaction $Be^9(d,n)B^{10}$ using deuterons accelerated at 2 Mev. by a van de Graaff accelerator. The available neutron flux is measured by the activation of metal foils. An apparatus for automatic irradiation and measurement of radioactivities having half lives on the order of 10 sec is described. (auth)

2633

TITRIMETRIC DETERMINATION OF ZIRCONIUM IN MAGNESIUM ALLOYS. Philip J. Elving (Univ. of Michigan, Ann Arbor) and Edward C. Olson (Upjohn Co., Kalamazoo, Mich.). Anal. Chem. **28**, 251-2 (1956) Feb.

The titrimetric measurement of Zr by standard cupferron solution, employing amperometric detection of the equivalence point, has been applied to the direct determination of Zr in commercial alloys following acid dissolution. (auth)

2634

THE CLINICAL SIGNIFICANCE OF ERYTHROCYTE CHOLINESTERASE TITERS. I. A METHOD SUITABLE FOR ROUTINE CLINICAL USE, AND THE DISTRIBUTION OF NORMAL VALUES. Jean Captain Sabine (Los Alamos Scientific Lab., N. Mex.). Blood **10**, 1132-8 (1955) Nov.

2635

POTENTIOMETRIC TITRATION OF THORIUM AND CERIUM NITRATES WITH GLASS ELECTRODE. Kuan Pan and Tong Ming Hseu (National Taiwan Univ.). Bull. Chem. Soc. Japan **28**, 309-12 (1955) July.

Thorium nitrate was potentiometrically titrated with sodium and ammonium oxalates by using glass electrode as an indicator electrode. Four inflections were found in the titration curves of the thorium-oxalate system. The first steep inflection, corresponding to the precipitation of thorium dioxide, was found at the mole ratio of $C_2O_4^{2-}$ to Th^{4+} , viz., the "R" value, 1.9 and at pH 4.3. The second the third and the fourth inflections, corresponding to the formation of thoroxalate complexes were found at the approximate R value of 3.4, and 6, and at pH values ranging from 5.4 to 6.3. Thorium and cerium nitrates were potentiometrically titrated by sodium hydroxide in dilute solutions with glass electrode. By reducing ceric to cerous ions in a solution containing thorium ion, and by titrating the resulting solution with sodium hydroxide solution, two steps of inflection, corresponding to the precipitation of thorium and cerous hydroxides, were found respectively, in the titration curve. In applying this method to the determination of thorium and cerous ions in the presence of one another, however, the experimental results obtained from the titration curve must be multiplied by the experimental factors which are both greater than unity for accuracy. (auth)

2636

CHARACTERIZATION OF A GLYCOPROTEIN IN THE URINE OF PATIENTS WITH PROTEINURIA. Edwin A. Popenoe (Brookhaven National Lab., Upton, N. Y.). J. Biol. Chem. **217**, 61-6 (1955) Nov.

It has been shown that the principal trichloroacetic acid-soluble protein in the urine of children with nephrotic syndrome is indistinguishable from the alpha one acid glycoprotein of normal human plasma by electrophoresis, by analysis for hexose, hexosamine, and nitrogen, and by a specific precipitin tests. (auth)

2637

PHYSICO-CHEMICAL STUDIES ON THE COMPLEX FORMATION BETWEEN THORIUM ION AND OXALATE ION. PART II. THERMOMETRIC AND CRYOSCOPIC TITRATIONS. Monisha Bose and D. M. Chowdhury (Univ. Coll. of Science, Calcutta). J. Indian Chem. Soc. **32**, 673-8 (1955) Oct.

The existence of different thoro-oxalates in solution has been corroborated by thermometric and cryoscopic titrations with thorium nitrate-potassium oxalate systems. (auth)

2638

ANALYTICAL ASPECTS OF SOME ORGANIC COMPOUNDS. PART I. SOME PHENOLIC ACIDS IN THE ESTIMATION OF THORIUM AND ZIRCONIUM. Sachindra Kumar Datta (Darjeeling Government Coll., India). J. India Chem. Soc. **32**, 687-93 (1955) Oct.

Analytical properties of some substituted phenolic acids, namely 5-bromo-, 5-nitro-, 5-amino-salicylic acids, β -resorcylic and bromoresorcylic acids have been studied. Gravimetric determinations of thorium and zirconium have been made with some of these acids. β -Resorcylic and 5-nitrosalicylic acids may be used for the separation of thorium and zirconium by suitable control of the acid concentration of the mixture. Separations of thorium from cerite earths and monazite and of thorium and zirconium from other metals have also been indicated. (auth)

Refer also to abstracts 2691 and 2736.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

2639 UCRL-3190

California. Univ., Berkeley. Radiation Lab. THE CRYSTAL STRUCTURE OF GOLD(III) CHLORIDE (thesis). Edward S. Clark. Nov. 8, 1955. 48p. Contract W-7405-eng-38.

Gold(III) chloride is a monoclinic, space group $P2_1/c$, with cell dimensions $a = 6.57\text{\AA}$, $b = 11.04\text{\AA}$, $c = 6.44\text{\AA}$, $\beta = 113^\circ 19'$. The structure consists of planar molecules Au_2Cl_6 , in which each Au atom is surrounded by four Cl atoms at the corners of a slightly distorted square. (auth)

DEUTERIUM AND DEUTERIUM COMPOUNDS

2640

HYDROGEN ISOTOPE FRACTIONATION BETWEEN ICE AND WATER. Ralph E. Weston, Jr. (Brookhaven National Lab., Upton, N. Y.). Geochim. et Cosmochim. Acta **8**, 281-4 (1955) Dec.

The equilibrium constant for the exchange of deuterium

between ice and water is calculated from available thermodynamic data. At 0°C, ice is enriched in deuterium by 1.92% compared to the water with which it is in equilibrium. The effect of dissolved salts is estimated to be only a lowering of the freezing-point. The application to some natural processes is considered. (auth)

2641

THE KINETICS OF HOT DEUTERIUM ATOMS IN THE PHOTOLYSIS OF DEUTERIUM IODIDE. Robert J. Carter, William H. Hamill, and Russell R. Williams, Jr. (Univ. of Notre Dame, Ind.). *J. Am. Chem. Soc.* **77**, 6457-60(1955) Dec. 20.

Deuterium atoms with large kinetic energy have been produced by photolysis of gaseous DI. The reaction of these hot D atoms with hydrogen, methane, ethane and neopentane has been studied as a function of composition, wave length, temperature, and added rare gas. With hydrogenous substrates the ratio of hot atom reaction producing HD to moderation producing thermal D atoms has been measured. The variation of the ratio D_2/HD with experimental conditions is described by a simple mechanism. Efficiencies of moderators are correlated with their molecular properties. (auth)

2642

RECOMMENDED VALUES FOR THE THERMODYNAMIC PROPERTIES OF HYDROGEN AND DEUTERIUM PEROXIDES. Paul A. Giguere and I. D. Liu (Laval Univ., Quebec, Canada). *J. Am. Chem. Soc.* **77**, 6477-9(1955) Dec. 20.

Recent spectroscopic and calorimetric data on H_2O_2 have been used to recalculate the thermodynamic functions of that compound. The contribution of the internal rotation mode was estimated using an equivalent potential barrier height of 4.45 kcal based on the third law entropy. Similar calculations were carried out for the isotopic molecules D_2O_2 and HDO_2 . Various derived thermodynamic quantities of the peroxide molecules are tabulated. From these the dissociation energy $D(HO-OH)$ is found to be 51 kcal at 0°K. (auth)

FLUORINE AND FLUORINE COMPOUNDS

2643 AERE-C/M-260

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

AN APPARATUS FOR THE DISPOSAL OF FLUORINE ON A LABORATORY SCALE. G. Long. Oct. 1955. 5p.

The apparatus in which F_2 is burnt in a coal-gas flame and the combustion products adsorbed in caustic soda solution is described. Flow rates of up to 15 l/hr have been handled. (auth)

2644 NRL-4686

Naval Research Lab., Washington, D. C.
BOUNDARY LUBRICATION STUDIES OF TYPICAL FLUOROESTERS. Interim Report. R. C. Bowers, R. L. Cottingham, T. M. Thomas, and W. A. Zisman. Dec. 28, 1955. 42p. Project NR-602-030.

The boundary lubricating and wear preventive properties of some new fluorinated diesters which offer many advantages as high temperature lubricants have been investigated. These diesters were synthesized from aliphatic dibasic acids and nearly completely fluorinated alcohols.

Friction and wear measurements were made at temperatures from 77 to 400°F. Fluoroesters containing typical antiwear or oiliness additives were also studied. For comparative purposes results obtained with the familiar unfluorinated diester, bis(2-ethylhexyl) sebacate, are included. The frictional properties of the two classes of diesters did not differ sufficiently to be of practical significance. However, the fluoroesters had better wear-preventive properties, especially at higher temperatures. Friction was markedly reduced by the addition of one % stearic acid to either type of diester. The addition of two % tricresyl phosphate was more effective in the fluoroester as an antiwear agent for hard steel on hard steel; approximately the same low wear rates were observed at 140, 266, and 400°F. (auth)

2645 WADC-TR-54-580

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

EVALUATION OF ORGANIC FLUORINE COMPOUNDS FOR USE IN MILITARY AIRCRAFT. Harold Rosenberg and J. C. Mosteller. Apr. 1955. 21p.

Fluoroorganic compounds were studied for use as fire-extinguishing agents, acid-resistant coatings and greases, hydraulic fluids, elastomers, and fungicides. Desirable properties of fluoroorganic compounds include wide liquid range, unusual stability, good conduction and heat-transfer characteristics, and decreased flammability. (C.W.H.)

2646

NON-EXCHANGE OF F^{18} BETWEEN HF AND FLUORINATED METHANES. James E. Boggs, E. R. Van Artsdalen, and A. R. Brosi (Oak Ridge National Lab., Tenn.) *J. Am. Chem. Soc.* **77**, 6505-6(1955) Dec. 20.

No exchange of F was observed between HF and the compounds CH_2F_2 , CHF_3 , CF_4 , or CF_2Cl_2 in 1 hr at temperatures up to 500°C or between CH_3F and HF up to 400°C in 1 hr. (auth)

2647

THE MOLAR REFRACTIONS OF SOME COMPLEX IONS IN SOLUTION. Max T. Rogers and Jim G. Malik (Michigan State Univ., East Lansing). *J. Am. Chem. Soc.* **77**, 6515-17(1955) Dec. 20.

The refractive indices at 20°C of aqueous solutions of several compounds containing complex fluoride ions were measured. Ionic refractivities of BF_4^- , SiF_6^{2-} , TiF_6^{2-} , $Fe(CN)_6^{3-}$ and $Fe(CN)_6^{4-}$, were determined. (C.W.H.)

GRAPHITE

2648 AECU-3142

[Argonne National Lab., Lemont, Ill.]
REACTION OF GRAPHITE WITH SODIUM. G. L. Montet. June 19, 1952. Decl. Jan. 17, 1956. 3p. Contract [W-31-109-eng-38]. (ANL-GRH-16). \$1.80(ph OTS); \$1.80(mf OTS).

The literature on the reaction of graphite with Na was reviewed. From the evidence gathered it seems probable that pure graphite and pure liquid Na will react only slowly at moderate temperatures. However, liquid Na rapidly attacks amorphous C, so that incompletely graphitized graphite would probably be more susceptible to attack. Since irradiation is known to produce electron acceptors in graphite it seems likely that irradiated graphite should re-

act more readily with liquid Na than unirradiated graphite. In view of the conflicting evidence available, the use of graphite in direct contact with liquid Na is not recommended except under very mild conditions of temperature and irradiation, and then only with very pure Na and completely graphitized graphite. (C.H.)

2649 NAA-SR-196

North American Aviation, Inc., Downey, Calif.

THE THERMOELECTRIC POWER OF GRAPHITE DEPENDENCE ON TEMPERATURE, TYPE AND NEUTRON IRRADIATION. W. P. Eatherly and N. S. Rasor. Nov. 21, 1952. Decl. Oct. 18, 1955. 31p. Contract AT-11-1-Gen-8.

The thermoelectric power of nine grades of artificial and natural graphites has been measured in the temperature region 4.2 to 300°K. The effect of neutron exposure on the temperature dependence in this interval has also been determined, including Hanford irradiations up to 2000 Mwd/ct. An analytical expression for the thermoelectric power has been derived, employing a two-dimensional band structure and a constant mean free path. This expression is in excellent qualitative agreement with the experimental data and implies a marked similarity in interpretation of the Hall effect and thermoelectric power. It is concluded that the thermoelectric power is a reliable measure of the number of conduction electrons and that the variation observed among grades of graphite is similar to the effect produced by slight changes in the number of conduction electrons. This variation in grade is correlated with particle size, which suggests the filling of the conduction band is dependent upon the existence of Tamm (surface) states or electrons bound to incompletely graphitized regions. (auth)

LABORATORIES AND EQUIPMENT

2650 AERE-C/R-1757

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A QUARTZ FIBRE ULTRA MICROBALANCE FOR USE INSIDE AN EVACUATED CONTAINER. W. P. Hutchinson. Oct. 7, 1955. 15p.

A fused quartz fibre ultra microbalance is described, using weights in conjunction with a torsion fibre, with a sensibility of about 10^{-8} g/division. It may be used in a vacuum for weighing quantities from a few μ g to 200 mg. (auth)

2651

INEXPENSIVE MICROTITRATOR. Kenneth A. Allen (Oak Ridge National Lab., Tenn.). Anal. Chem. **28**, 277(1956) Feb.

The construction and performance of an inexpensive microtitrator are described. The buret consists of a glass-jacketed precision-bore tube with an oversize teflon plunger which is controlled by a micrometer. Titrations requiring 10 μ l of reagent may be completed in less than 15 minutes, and the delivered volumes read to within 2 parts in a thousand. (C.W.H.)

RADIATION CHEMISTRY

2652

BOND RUPTURE AND NONRUPTURE IN THE BETA DE-

CAY OF CARBON-14 STUDIED BY DOUBLE ISOTOPIC LABELING. Richard L. Wolfgang, R. Christian Anderson, and Richard W. Dodson (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. **24**, 16-23(1956) Jan.

The effect of β decay of a constituent carbon atom of the ethane molecule has been studied by a technique of double labeling, with $C^{14}H_3C^{14}H_3$. The radioactivity of one of the C atoms served as a tracer for the entity which results from the decay of the other to nitrogen when the chemical bond is preserved. It was found that in 47% of the cases the molecular entity was not disrupted but survived as methyl amine, $C^{14}H_3NH_2$. This result is in good agreement with theoretical expectations. (auth)

2653

EXCITATION AND DISSOCIATION OF MOLECULES DUE TO β DECAY OF A CONSTITUENT ATOM. Max Wolfsberg (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. **24**, 24-32(1956) Jan.

The theory of electronic, vibrational, and rotational excitation of a molecule, specifically a diatomic molecule, due to β decay of a substituent atom is presented. The nature of the vibrational and rotational excitation for certain specific cases is mathematically investigated. The problem of dissociation arising from the excitation of rotations is discussed. It is shown that it is very difficult to obtain exact figures on the probability of dissociation due to the excitation of vibrations and rotations. Molecular orbital wave functions are employed to gain some insight into the electronic excitation of the daughter molecule. A very rough calculation is made of the probability of nondissociation in the decay of C^{14} labeled ethane. (auth)

2654

YIELD OF THE FERROUS SULFATE RADIATION DOSIMETER: AN IMPROVED CATHODE-RAY DETERMINATION. Robert H. Schuler and Augustine O. Allen (Brookhaven National Lab., Upton, N. Y.). J. Chem. Phys. **24**, 56-9 (1956) Jan.

A redetermination of the absolute yield G of ferrous sulfate oxidation by 2-Mev cathode rays has been made improved accuracy. The corrections for backscattering and charge transfer have been critically re-examined, the correction for absorption of energy in the windows has been determined experimentally and an improved method of determining the energy of the rays is described. The value of G is 15.45 ± 0.11 and is independent of radiation intensity (auth)

RADIATION EFFECTS

2655 IDO-14347

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

RADIATION STABILITY OF CHROMIUM(VI) IONS IN ACETATE BUFFERED SOLUTIONS. Robert L. Andelin and Edward L. Anderson. Aug. 22, 1955. 25p. Contract AT(10-1)-205. \$0.25(OTS).

Chromium(VI) ions are reduced to Cr^{3+} in acidic acetic acid-sodium acetate buffered solutions when subjected to intense gamma irradiations. The reduction rate of a 0.5M chromate solution buffered with 4.0M acetate is 2.35 ± 0.15 millimoles per kilocalorie at pH 4 in a gamma field of approximately 10^7 r/hr. The decomposition rate is reduced to 0.51 ± 0.15 millimoles per kilocalorie by the

addition of 0.5M sodium bromide. The reduction rate is independent of intensity of irradiation, of chromate concentration in the range 0.05M to 0.5M, and of bromide concentration in the range of 0.1M to 1.0M. It is a function of acetate concentration, however, and decreases with decreasing acetate concentration in the range 4.0M to 0.1M. In a 0.1M chromate solution buffered with 0.1M acetate at pH 4.0 and containing 0.1M sodium bromide as a protector, the chromate reduction rate is 0.18 ± 0.03 millimoles per kilocalorie. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

2656

THE THERMOLYSIS OF THE NEOCUPFERRON CHELATES OF YTTRIUM AND THE RARE EARTH ELEMENTS. Wesley W. Wendlandt and John M. Bryant (Texas Technological Coll., Lubbock). *Anal. Chim. Acta* **13**, 550-3 (1955) Dec.

The thermolysis curves of the neocupferron chelates of Y, La, Ce^{3+} , Ce^{4+} , Pr, Nd, Sm, and Gd were determined. It was found that the chelates were stable up to 80°, with the oxide levels being reached at 460 to 750°C. (auth)

2657

THE HEAT OF COMBUSTION OF SAMARIUM. Elmer J. Huber, Jr., Clayton O. Matthews, and Charles E. Holley, Jr. (Los Alamos Scientific Lab., N. Mex.). *J. Am. Chem. Soc.* **77**, 6493-4 (1955) Dec. 20.

Calorimetric combustions of Sm metal were conducted at an initial temperature of 25° under an oxygen pressure of 25 atm. The energy of combustion under these conditions was found to be 6020.0 ± 6.6 joules/g. The corresponding standard heat of formation of the sesquioxide (B-type) from the elements is calculated to be -1815.4 ± 2.0 kjoules/mole. (auth)

SEPARATION PROCEDURES

2658 ACCO-25

American Cyanamid Co. Atomic Energy Div. Raw Materials Development Lab., Winchester, Mass. A REGENERATIVE ELECTROLYTIC PROCESS FOR RECOVERING URANIUM FROM ORES. Galen W. Clevenger. Aug. 29, 1952. Decl. Sept. 23, 1955. 17p. Contract AT(49-1)-533.

A process is proposed wherein solutions obtained from leaching ores for their uranium content with sodium carbonate is passed through the cathode chamber of a compartmented electrolytic cell at a rate regulated to maintain the NaOH concentration of the catholyte to cause precipitation of uranium. In addition to this NaOH an equivalent amount of $NaHCO_3$ is produced at the anode. Following the removal of the uranium by filtration the catholyte is passed through the anode chamber where the NaOH combines with the $NaHCO_3$ in the anolyte to regenerate the Na_2CO_3 which is reused to leach additional ore. Using Lukachukai ore with a uranium assay of about 0.29% U_3O_8 power consumed was 21 kilowatt hours per pound of U_3O_8 recovered. In addition to electric power five pounds of Na_2CO_3 and less than one pound of NaOH per pound of U_3O_8 recovered were consumed. The overall recovery in a precipitate assaying 68% U_3O_8 was 97%, the residue assay being 0.007% U_3O_8 . (auth)

2659 ACCO-29

American Cyanamid Co. Atomic Energy Div., Raw Materials Development Lab., Winchester, Mass. THE APPLICATION OF THE ELECTROLYTIC URANIUM RECOVERY PROCESS TO LIMESTONE ORE FROM GRANTS, NEW MEXICO. Galen W. Clevenger. Sept. 1, 1953. Decl. Sept. 23, 1955. 24p. Contract AT(49-1)-533.

The Electrolytic Uranium Process was operated for ninety days using one kg of Grants limestone ore as feed each day. The indicated overall recovery in a precipitate assaying 75% U_3O_8 was 91%. Cost items of 9 kwh of electric power and 5 lbs of soda ash per lb of U_3O_8 were consumed. (auth)

2660 ACCO-42

American Cyanamid Co. Atomic Energy Div., Raw Materials Development Lab., Winchester, Mass. THE DEVELOPMENT OF A RESIN-IN-PULP PROCESS AND ITS APPLICATIONS TO ORES OF THE WHITE CANYON AREA OF UTAH. R. F. Hollis, C. S. Abrams, C. K. McArthur, and T. F. Izzo. June 18, 1954. Decl. Sept. 23, 1955. 24p. Contract AT(49-1)-533.

A description of development of the process for the recovery of uranium from acid slurries without accomplishing a liquid-solid separation is presented. Metallurgical results obtained from testing two ores from the White Canyon Area of Utah with this process are given. (auth)

2661 ACCO-52

American Cyanamid Co. Atomic Energy Div. Raw Materials Development Lab., Winchester, Mass. TWO STAGE LEACHING TESTS ON UTEX ORE. Alan Stanley, Robert Eisenhauer, and Stanley Richardson. July 22, 1954. Decl. Sept. 23, 1955. 16p. Contract AT(49-1)-533.

Over 99% of the uranium was extracted from samples tested by two-stage leaching methods using 570 lb H_2SO_4 and 15 lb MnO_2 per ton of ore for 16 hr at 40°C after a four-hour neutral leach. In a closed circuit system, ion exchange difficulties must be solved before commercial use can be made of the system. An open circuit system offers an efficient method of lime neutralization and uranium recovery. (auth)

2662 DOW-119

Dow Chemical Co. Western Div., Pittsburg, Calif. PROPOSED HCl RECOVERY SYSTEM, SALT LAKE CITY PILOT PLANT. J. F. Valle-Riestra. Aug. 20, 1954. Decl. Sept. 29, 1955. 22p. Contract AT-30-1-GEN-236.

A design is presented for a system to recover hydrochloric acid currently being wasted in the existing solvent extraction pilot plant in Salt Lake City. The recovery system would serve as a demonstration unit analogous to a similar unit required in any large-scale commercial plant for the purpose of reducing acid costs. (auth)

2663 KAPL-834

Knolls Atomic Power Lab., Schenectady, N. Y. DETERMINATION OF THE SPECIFIC HEATS OF SOME PUREX SOLVENTS AND DILUENTS. Arthur Dreeben. Oct. 18, 1952. Decl. Oct. 4, 1955. 18p. Contract W-31-109-Eng-52.

Approximate specific heats at 25 and 61°C have been determined for some Purex organic solvents and diluents to aid in calculations of probable temperature rises during the steam jetting of organic streams. (auth)

2664 RMO-2519

Rohm and Haas Co. Research Labs., Philadelphia.
THE ELECTROLYTIC RECOVERY OF URANIUM AND VANADIUM FROM CARBON LEACH LIQUORS BY MEANS OF ION EXCHANGE MEMBRANES. Jean Saunders. Apr. 6, 1953. Decl. Sept. 23, 1955. 15p. Contract AT-(49-1)-535.

Experiments were carried out to determine conditions for effectively precipitating U from Monticello leach liquors of high V content by electrolytic methods. The conditions prescribed appear to be economically feasible. They permit removal of as much as 95% of the U from liquor, but very little V. (auth)

2665 RMO-2532

Rohm and Haas Co. Research Labs., Philadelphia.
CYCLIC TESTING OF ROHM AND HAAS COMPANY AMBERLITE ANION EXCHANGE RESINS FOR THE RECOVERY OF URANIUM. Charles T. Dickert and Albert F. Preuss. Mar. 23, 1955. Decl. Sept. 23, 1955. 38p. Contract AT-(49-1)-535.

Two experimental anion exchange resins, Amberlite XE-137 and Amberlite XE-138, which exhibit high uranium adsorption capacities were tested for 100 cycles using a synthetic South African leach liquor. Amberlite IRA-400 was run in parallel to have a control on rate of fouling and loss of uranium capacity. (auth)

2666

A SOLVENT PROCESS FOR THE EXTRACTION OF PLUTONIUM FROM URANIUM IRRADIATED IN REACTORS. Bertrand Goldschmidt and Isabelle Prevot. *Bull. soc. chim.* France, No. 1, 103-6(1956) Jan. (In French)

A description is given for the conditions of the separation of Pu, fission products, and U by means of a selective extraction of the nitrates by tributyl phosphate diluted with a paraffin hydrocarbon. The Pu and U are first extracted simultaneously, and then they are successively re-extracted by reduction. Since the decontamination of γ emitters is inadequate in the first cycle, the complementary treatments of U and Pu, in order to obtain amounts of the desired purity, are also indicated. Also, a description is given for a process of nitric dissolution of active U, without liberating vapors, allowing the reclamation of radioactive gases. The final concentration of fission products in a solution is described. (tr-auth)

2667

THE PARTIAL SEPARATION OF Na^{22} FROM Na^{24} BY ION EXCHANGE CHROMATOGRAPHY. R. H. Betts, W. E. Harris, and Margaret D. Stevenson (Atomic Energy of Canada Ltd., Chalk River, Ont.). *Can. J. Chem.* 34, 65-74 (1956) Jan.

The separation of Na^{22} from Na^{24} by ion exchange chromatography was investigated. Using Dowex 50 resins, partial isotopic separations of 8 to 10% were obtained. (C.W.H.)

2668

ION EXCHANGE IN CONCENTRATED SOLUTIONS, NaCl - HCl AND LiCl - HCl SYSTEMS. Hidetake Kakihana, Nobuo Maruichi, and Kazuo Yamasaki (Yagoya Univ., Japan). *J. Phys. Chem.* 60, 36-40(1956) Jan.

Ion exchange was studied in the concentrated solutions of NaCl - HCl and LiCl - HCl systems. The amount of H_2O adsorbed in the resin was calculated from the difference of the amount of hydrogen ion before and after the ion-

exchange equilibrium. The amount of adsorbed water decreases as the concentration of chloride ion increases both in NaCl - HCl and LiCl - HCl systems. Differences were found between NaCl - HCl and LiCl - HCl systems. The anomaly found in the latter system was explained by assuming the dehydration of Li ion in concentrated solutions. In NaCl - HCl system the Donnan equilibrium was found to exist between the resin and the solution phases. The same equilibrium exists only in 0.1 and 0.3N solutions in the LiCl - HCl system. (auth)

2669

SOLVENT EXTRACTION SEPARATION OF COBALT AND NICKEL WITH THIOCYANATE AND THE PREPARATION OF NICKEL-FREE COBALT SALTS. Rodman A. Sharp and Geoffrey Wilkinson (Harvard Univ., Cambridge, Mass.). *J. Am. Chem. Soc.* 77, 6519-21(1955) Dec. 20.

The thiocyanate-hexone extraction method for the separation of Co from Ni is described. This method is used to prepare Ni-free Co salts and to separate Ni^{57} tracer from proton-bombarded Co. (C.W.H.)

Refer also to abstracts 2677, 2678, 2687, 2688, 2689, and 2690.

SYNTHESES

2670 AGC-1229-6

Aerojet General Corp., Azusa, Calif.
INORGANIC AND SEMI-ORGANIC POLYMERS. Bi-monthly Progress Report No. 6 [for] October 1 through November 30, 1955. C. L. Randolph. Dec. 5, 1955. 17p. Contract AF33(616)-2739.

The homogeneity of the organoboron phosphonate



extracting medium. Pyrolysis studies of this material in vacuo indicate that cleavage of the B-C bond occurs between 110 and 250°C, and of the P-C bond above 250°C. The cleavage is probably hydrolytic inasmuch as water, in small amounts, was detected in the fractions collected between 110 and 400°C. The addition of 3.5% dibutyl butylphosphonate to a commercially available silicone resin was found to improve the thermal stability of the resin. Tri-[trimethylsilyl] phosphate was synthesized and characterized. It distills at 237°C (atm) with some decomposition; heating in vacuo for 16 hr at 300°C resulted in the formation of a small amount of disiloxane as the only volatile product. The silyl phosphate is readily hydrolyzed by water. (For preceding period see AGC-1229-5.) (auth)

2671 UCLA-356

California. Univ., Los Angeles. Atomic Energy Project.
PREPARATION OF OLEIC-1- C^{14} ACID. Judd C. Nevenzel and David R. Howton. Dec. 12, 1955. 16p. Contract AT-04-1-GEN-12. \$3.30(ph OTS); \$2.40(mf OTS).

Oleic-1- C^{14} acid has been prepared by a series of reactions paralleling those employed earlier in preparing linoleic-1- C^{14} acid. Addition of bromine to oleic acid yields threo-9,10-dibromostearic acid, the Ag salt of which is treated with Br to yield threo-1,8,9-tribromoheptadecane. The action of Zn on this substance yields cis-8-

heptadecenyl bromide, the Grignard reagent of which, on reacting with $C^{14}O_2$, gives oleic-1- C^{14} acid. (auth)

2672

SYNTHESIS OF COFFINITE— $USiO_4$. Henry R. Hoekstra and Louis H. Fuchs (Argonne National Lab., Lemont, Ill.). *Science* **123**, 105(1956) Jan. 20.

TRACER APPLICATIONS

2673

PRODUCT LABELING OF GLUCOSE-1- C^{14} FERMENTATION BY HOMOFERMENTATIVE AND HETEROFERMENTATIVE LACTIC ACID BACTERIA. Martin Gibbs, J. T. Sokatch, and I. C. Gunsalus (Brookhaven National Lab., Upton, N. Y. and Univ. of Illinois, Urbana). *J. Bacteriol.* **70**, 572-6(1955) Nov.

2674

STUDIES OF HIGH POLYMERS BY RADIOACTIVE METHOD. I. SELF-DIFFUSION OF IONS IN ION EXCHANGERS. Shintaro Sugai and Jiro Furuichi (Hokkaido Univ., Sapporo, Japan). *J. Phys. Soc. Japan* **10**, 1032-40(1955) Dec.

In order to study kinetic exchange reaction and self-diffusion of ions in ion exchangers, the rate of ion exchange was measured by a radioactive tracer method similar to that employed by A. Langer and Pitts' general theory of radioactive ion exchange was applied, with attention given to the rate determining factor of reaction in each case, to analyze the results. When concentrated external solution is utilized, diffusion of cation in cation exchangers and diffusion of anion in anion exchangers was suggested to be the controlling factor, whereas in the case of the use of dilute external solution, the rate of exchange is probably controlled by surface diffusion. In the former case, diffusion coefficients, activation energy of diffusion, and activation entropy of diffusion were calculated, and from the results obtained, the mechanism of diffusion in the exchange resins was discussed. (auth)

TRANSURANIC ELEMENTS AND COMPOUNDS

2675

ELECTROLYTIC OXIDATION OF PLUTONIUM. Roy Ko (Hanford Atomic Products Operation, Richland, Wash.). *Anal. Chem.* **28**, 274(1956) Feb.

The electrolytic oxidation of Pu^{4+} to Pu^{6+} in perchloric acid solutions is described. The plutonium was 98% oxidized under the following conditions: acid concentration—0.5M $HClO_4$; current—60ma; anodic current density—3ma/cm²; and electrolysis time—1 hr. (C.W.H.)

2676

THE PREPARATION AND PROPERTIES OF SOME PLUTONIUM COMPOUNDS. PART II. PLUTONIUM NITRIDE. F. Brown, Heather M. Ockenden, and G. A. Welch (U. K. Atomic Energy Authority (Industrial Group), Windscale Works, Cumberland, England). *J. Chem. Soc.* **1956**-4201(1955) Dec.

Plutonium nitride has been prepared by two methods: by heating the metal in nitrogen to a high temperature and by heating plutonium hydride in nitrogen to a temperature above 230°. In each case the product was the same, PuN .

Unlike the mixture of refractory uranium nitrides obtained under similar conditions, plutonium nitride is quite reactive and very easily decomposed. Complete hydrolysis occurred within a few hours at 80 to 90° in moist air or within a few days at room temperature. The use of a thermobalance has provided data on the formation and oxidation of the nitride. (auth)

URANIUM AND URANIUM COMPOUNDS

2677 ACCO-31

American Cyanamid Co. Atomic Energy Div. Raw Materials Development Lab., Winchester, Mass. EXAMINATION OF POISONED ION EXCHANGE RESINS FROM THE WESTERN REEFS PILOT PLANT. R. H. Kennedy. Feb. 19, 1953. Decl. Sept. 23, 1955. 16p. Contract AT(49-1)-533.

Tests were made to determine the cause of the decrease in U adsorption capacity of several samples of anion resins which had been used at the Western Reefs U pilot plant. Most of the capacity loss is due to S and SiO_2 deposited in the resin, and may be restored by a special treatment with sodium sulfide. There is an appreciable amount of Co on the resin for which no satisfactory method of removal was found. (auth)

2678 ACCO-55

American Cyanamid Co. Atomic Energy Div. Raw Materials Development Lab., Winchester, Mass. STUDIES ON DIRECT EXTRACTION OF URANIUM FROM SYNTHETIC ORES BY NON AQUEOUS SYSTEMS. Ralph A. Zingaro. July 19, 1954. Decl. Sept. 23, 1955. 12p. Contract AT(49-1)-533.

The direct extraction of synthetic ores containing UO_3 , U_3O_8 , and UO_2 by six organophosphate esters in acetone was investigated. Only the UO_3 ore was amenable to this method. Concentration studies indicated that as little as 2% of organophosphate was sufficient. Oxidation of UO_2 and U_3O_8 ores, prior to extraction, indicated that certain oxidizing agents were successful in converting these oxides into forms which were easily extractable. Hot, aqueous Cl_2 and Br_2 brought about 95% extractions of these materials. Some new uranium complexes of U, soluble in polar organic solvents, but insoluble in water were obtained by treatment of UO_2^{2+} with xanthate and dithiocarbamate. (auth)

2679 AECD-3701

California Research and Development Co. Livermore Research Lab., Livermore, Calif. URANIUM-ZIRCONIUM DIFFUSION STUDIES. D. R. Mash and B. F. Disselhorst. June 1954. Decl. with deletions Nov. 14, 1955. 41p. Contract AT(11-1)-74.

Uranium diffusion into Zr cladding of clad U sheet specimens was studied over the temperature range from 300 to 1050°C for times up to 1812 hr. Metallographic observation of progressive growth of zirconium diffusion zone as a function of time at various temperatures was carried out. Data are presented which yields the following equations for rate of diffusion. Above 600°C, $K = 17,200 \exp [-44,325/2RT]$ mils/hr^{1/2}; below 600°C, $K = 0.328 \exp [-8,864/2RT]$ mils/hr^{1/2} where K = penetration coefficient, R = universal gas constant, and T = temperature. (auth)

2680 BMI-870

Battelle Memorial Inst., Columbus, Ohio.

THE SOLUBILITY OF HYDROGEN IN URANYL SULPHATE SOLUTIONS AT ELEVATED TEMPERATURES. H. A.

Pray and E. F. Stephan. Sept. 25, 1953. Decl. Sept. 30, 1955. 18p. Contract W-7405-eng-92.

The solubility of H_2 in UO_2SO_4 solutions and in H_2O at 212, 275, and 325°F, and at H_2 partial pressures up to 1500 psia was investigated. The results are presented in tabular and graphic form. The solubility is proportional to the partial pressure of H_2 . The ratio of solubility in the UO_2SO_4 solution to solubility in H_2O at the same temperature and pressure is a function of the concentration of the salt in solution. (auth)

2681 BMI-897

Battelle Memorial Inst., Columbus, Ohio.

THE SOLUBILITY OF OXYGEN AND HYDROGEN IN URANYL FLUORIDE SOLUTIONS AT ELEVATED TEMPERATURES. H. A. Pray and E. F. Stephan. Jan. 18, 1954. Decl. Sept. 30, 1955. 22p. Contract W-7405-eng-92.

The solubility of O_2 and H_2 in UO_2F_2 solutions at 212, 275, and 325°F, and at partial pressures up to 1500 psia are presented in tabular and graphic forms. The solubility is proportional to the partial pressure of the gas. The ratio of solubility in the UO_2F_2 solution to solubility in water at the same temperature and pressure is a function of the concentration of the salt in solution. (auth)

2682 K-120

Carbide and Carbon Chemicals Corp. K-25 Plant, Oak Ridge, Tenn.

ELECTROPOLISHING OF NICKEL DISKS FOR PRECISION COUNTING ANALYSES. R. E. Greene. Jan. 30, 1948. Decl. Sept. 8, 1955. 16p. Contract [W-7405-eng-26].

An electropolisher is described for surfacing nickel disks that are used in radiometric analyses for uranium. A mirror-like surface can be produced with an appropriate combination of electrolyte and current density. (C.W.H.)

2683 KAPL-1154

Knolls Atomic Power Lab., Schenectady, N. Y.

ELECTROREFINING OF URANIUM—A NEW APPROACH. L. W. Niedrach and A. C. Glamm. Aug. 13, 1954. Decl. Oct. 4, 1955. 40p. Contract W-31-109-Eng-52.

A new approach is presented for the electrorefining of reactor fuels and its corollary, an improved electro-winning process to obtain such fuels from their compounds. Electrorefining is compared with other high-temperature methods of processing reactor fuels. The potential advantage of the method is indicated since it offers a means of separating the fuel material from both more active (chemically) and more noble fission products. Various approaches to electrorefining are then considered and the need for obtaining a molten metal product is stressed. The desirability of a molten metal anode is also discussed. The use of alloying agents to obtain molten electrodes is then considered, and the feasibility of using the alloying agent as the cathode is suggested. This procedure results in a cathode from which the molten alloy drips—a "dripping alloy cathode". This type of cathode offers several advantages over more conventional cathodes. The feasibility of producing molten alloys with a dripping cathode is demonstrated with a uranium-nickel system. Good current efficiencies are demonstrated, and the effect of the common variables of temperature, bath

composition, current, etc., are illustrated. The feasibility of prolonged electrolysis with such a system is also indicated. (auth)

2684 MLM-729

Mound Lab., Miamisburg, Ohio.

THE pH MEASUREMENT OF URANYL SULFATE SOLUTIONS FROM 25° TO 60°C. Edward Orban. Aug. 1, 1952. Decl. Oct. 13, 1955. 12p. Contract AT-33-1-GEN-53. (Deleted version: AECD-3583.)

The pH of uranyl sulfate solutions has been measured from 25 to 60°C over a concentration range from 0.0006 to 3.9 molal. At 25°C the pH changes from 4.12 for the lowest concentration to 0.55 at the highest concentration, while at 60°C the change is from 3.97 to -0.12 for the same concentrations, respectively. (auth)

2685 ORNL-1989

Oak Ridge National Lab., Tenn.

THE CHEMISTRY OF URANIUM(VI) ORTHOPHOSPHATE SOLUTIONS. PART IV. A FURTHER SPECTROPHOTOMETRIC INVESTIGATION OF URANYL PHOSPHATE COMPLEX FORMATION IN PERCHLORIC ACID SOLUTION. C. F. Baes, Jr. Oct. 21, 1955. 36p. Contract W-7405-eng-26. \$6.30(ph OTS); \$3.00(mf OTS).

The spectrophotometric investigation of U^{6+} -orthophosphate complex formation in 1M and 0.1M $HClO_4$ has been continued. Detailed analysis of the results indicates that 1:1 and also 2:1 phosphate-U complexes are formed. The acidity dependence of the formation quotients $K_1 = C_U/C_U C_P$ and $K_2 = C_U/C_U C_P^2$ (in which C_U and C_P are the total concentrations of 1:1 and 2:1 complexes, C_U and C_P are the concentrations of uncomplexed U^{6+} and phosphoric acid) can be accounted for in terms of the complex species $UO_2H_2PO_4^+$, $UO_2H_3PO_4^{2+}$, $UO_2(H_2PO_4)_2$, and $UO_2(H_2PO_4)$ (H_3PO_4)⁺. (auth)

2686 RMO-2507

Rohm and Haas Co. Research Labs., Philadelphia.

ELECTROLYTIC PRECIPITATION OF URANIUM FROM CARBONATE LEACH LIQUORS. Paul F. Kirk. Aug. 6, 1952. Decl. Sept. 23, 1955. 12p. Contract AT(49-1)-535.

An electrolytic method has been investigated for the precipitation of U from carbonate leach liquors. This method, employing ion-exchange membranes gives dense, rapid settling precipitates at excellent recovery levels. The process also recovers the carbonate-bicarbonate solution used in ore leaching. (auth)

2687 RMO-2520

Rohm and Haas Co. Research Labs., Philadelphia.

THE ELECTROLYTIC RECOVERY OF URANIUM FROM VITRO LEACH LIQUOR BY MEANS OF ION EXCHANGE MEMBRANES. Norman W. Frisch. Apr. 9, 1953. Decl. Sept. 23, 1955. 15p. Contract AT(49-1)-535.

The investigation of the electrolytic precipitation of U from a sample of acid leach liquor in an ion exchange membrane cell has been conducted on leach liquor from the Vitro Co. This leach liquor can be treated by the above means to precipitate essentially all the U and simultaneously to produce additional acid which may be used for further leaching. (auth)

2688 RMO-2522

Rohm and Haas Co. Research Labs., Philadelphia.

ELECTROLYTIC PRECIPITATION OF URANIUM FROM BELGIAN CONGO ION EXCHANGE RESIN ELUATES IN

A THREE COMPARTMENT CELL. Norman W. Frisch. May 25, 1953. Decl. Sept. 23, 1955. 18p. Contract AT-(49-1)-535.

Electrolytic precipitation of U from ion-exchange resin eluates has been investigated in a three-compartment cell. A relatively low-energy consumption is required and anodic attack is reduced to a negligible quantity. During the precipitation, acid is produced in sufficient quantity for use as eluant for subsequent eluting operations. The recovered U is in the form of a rapid settling, fast filtering precipitate which is easily washed with water to reduce the chloride content to a tolerable concentration. (auth)

2689 RMO-2523

Rohm and Haas Co. Research Labs., Philadelphia. **THE PREVENTION OF COBALTICYANIDE POISONING OF ION EXCHANGE RESINS USED ON SOUTH AFRICAN GOLD ORE RESIDUE LEACH LIQUORS.** Al Preuss. June 3, 1953. Decl. Sept. 23, 1955. 16p. Contract AT-(49-1)-535.

As a result of the cobalticyanide fouling of the quaternary anion exchange resins with respect to U capacity, a study has been made on the use of a weak base anion exchange resin for a scavenger. It has been shown that Amberlite XE-114 can function as a scavenger in that it adsorbs cobalticyanide preferentially to U and that it can be efficiently eluted with caustic. (auth)

2690 RMO-2525

Rohm and Haas Co. Research Labs., Philadelphia. **THE ELECTROLYTIC RECOVERY OF URANIUM AND VANADIUM FROM CARBONATE LEACH LIQUORS.** Jean Saunders. July 17, 1953. Decl. Sept. 23, 1955. 15p. Contract AT-(49-1)-535.

Methods of obtaining U and V from carbonate leach liquors by ion exchange are described. Calculations of energy requirements are included; these indicate that the ion exchange methods discussed in this report will be economically feasible in regions where the cost of electricity is low or moderate. (auth)

2691

A RAPID METHOD FOR THE DETERMINATION OF URANIUM. Anna-Lisa Arnfelt (Aktiebolaget Atomenergi, Stockholm, Sweden), *Acta Chem. Scand.* 9, No. 9, 1484-91 (1955).

A spectrophotometric method for the determination of small concentrations ($\sim 10^{-3}\%$) of U in aqueous solutions containing also Fe, Al, Mg, and SO_4^{2-} is presented. The uranium is selectively adsorbed from sulfate solutions at pH=2 by Dowex 2, eluted with dilute HCl, and absorbance measurements made at 390m μ . (C.W.H.)

ENGINEERING

2692 AERE-Lib/Trans-606

A METHOD FOR THE GRAPHICAL CALCULATION OF THE NUMBER OF THEORETICAL PLATES IN AN ELECTROLYTIC PLANT WITH EXCHANGE TOWERS FOR PRODUCTION OF HEAVY WATER. D. Dinelli. Translated by J. B. Sykes from *Energia Nucleare* 2, 426-33(1955). 11p.

An abstract of this paper appears in *Nuclear Science Abstracts* as NSA 9-6950.

HEAT TRANSFER AND FLUID FLOW

2693 AD-67096

California Inst. of Tech., Pasadena. Guggenheim Aeronautical Lab.

AN EXPERIMENTAL INVESTIGATION OF PRESSURE GRADIENTS DUE TO TEMPERATURE GRADIENTS IN SMALL DIAMETER TUBES. Memorandum No. 27. Weston M. Howard. June 10, 1955. 22p. Contract DA-04-495-Ord-19.

Results of an experimental investigation of pressure gradients due to axial temperature gradients in small diameter tubes are presented. The tests, which covered the region of Knudsen numbers (based on tube inside radius) of 0.01 to 6, indicate good correlation with theory. It is of value to note that this correlation was obtained by using ΔT equal to the temperature difference between the hot and cold ends of the tubes and T_{ave} equal to the average of these two temperatures. In contrast, theory would dictate obtaining the temperature variation along the length of the tube and applying the formulas to small incremental ΔT 's, then summing to get the total effect. Therefore, for normal laboratory conditions where pressure gradient corrections are to be computed, it is sufficient to record only the temperatures at the hot and cold ends rather than having to obtain a number of temperature readings along the tube. In order to apply pressure corrections easily and rapidly, a system of correction curves is given. To simplify the procedure, the tube cold end temperature was assumed to be 80°F, and the correction curves drawn accordingly. However, for different laboratory conditions a similar system of curves could be drawn and used. (auth)

2694 AERE-Lib/Trans-591

AN APPROXIMATE METHOD OF CALCULATING A TURBULENT BOUNDARY LAYER IN THE PRESENCE OF HEAT EXCHANGE. M. B. Skopets. Translated by J. B. Sykes from *Zhur. Tekh. Fiz.* 25, 864-76(1955). 16p.

Of the semi-empirical methods at present existing for the calculation of an isothermal turbulent boundary layer in an incompressible gas, the most simple and convenient is that proposed by Loitsyanskii. This method is based on the use of the momentum equation and on the hypothesis of an analogy between laminar and turbulent boundary layers. In this work, a method is proposed for calculating a non-isothermal turbulent boundary layer in an incompressible gas, for the case of both small and large excess temperatures. This method is essentially a generalization of Loitsyanskii's to the case where heat exchange is present. (auth)

2695

TRANSIENT BEHAVIOR OF SINGLE-PHASE NATURAL-CIRCULATION LOOP SYSTEMS. C. D. Alstad, H. S. Isbin, N. R. Amundson (Univ. of Minnesota, Minneapolis), and J. P. Silvers (Argonne National Lab., Lemont, Ill.). *A.I.Ch.E. Journal* 1, 417-25(1955) Dec.

A useful method is reported for calculating temperatures and rates of flow in the unsteady-state operation of natural-circulation loops in single phase. A one-dimensional mathematical model is used with the assumptions that at any instant the volumetric rate of flow is constant around the loop and steady-state friction factors can be applied in transient operations. The loop, consisting of a heat source, heat sink, hot leg, cold leg, and connecting piping, is di-

vided into a number of finite increments. The transient behavior is calculated by the iterative application of the finite-difference momentum and energy balances. Numerical computations made for several cases of transient operations were carried out with the aid of the Standard Eastern Automatic Computer (SEAC). Comparisons of predicted with actual performances were checked by use of two experimental loops employing water and found satisfactory. (auth)

2696

HEAT TRANSFER IN CYLINDERS WITH HEAT GENERATION. Leonard Topper (Johns Hopkins Univ., Baltimore). *A.I.Ch.E. Journal* **1**, 463-6(1955) Dec.

The prediction of temperatures has been studied for a tubular flow reactor when heat is generated at a rate which is a linear function of the local temperature. Analytical solutions are presented both for the case where the wall is isothermal and for the case where the exterior surroundings are isothermal and the heat transfer coefficient between the tube wall and the surroundings is constant. (auth)

2697

HEAT TRANSFER TO WATER IN AN ANNULUS. Philip Miller, James J. Byrnes, and David M. Benforado (Walter Kidde Nuclear Labs., Inc., Garden City, N. Y.). *A.I.Ch.E. Journal* **1**, 501-4(1955) Dec.

Measurements were made of the heat transfer coefficient from an electrically heated rod to water flowing in an annulus. Tests were performed at Reynolds numbers ranging from 5,000 to 22,000 (based on equivalent diameter), water temperatures of 70 and 125°F., and relatively high heat fluxes of 52,000 to 208,000 Btu/(hr)(sq ft.). The annulus dimensions were 0.625 in. ID and 0.840 in. OD. The coefficients varied as the 0.8 power of the velocity; they were 20% higher than predicted for flow inside pipes with the equivalent diameter. Over the range of conditions studied, it was found that the thermal boundary layer was fully developed in $1\frac{1}{8}$ in. ($L_H/D_e = 5$). (auth)

2698

DYNAMICS OF VAPOR BUBBLES AND BOILING HEAT TRANSFER. H. K. Forster and N. Zuber. (Univ. of California, Los Angeles). *A.I.Ch.E. Journal* **1**, 531-5(1955) Dec.

Analytical expressions for bubble radii and growth rates are applied in an analysis of surface boiling at high heat transfer rates. It is shown that the product of bubble radius and radial velocity is a constant, independent of the bubble radius. This circumstance permits the formulation of a Reynolds number for the flow in the thin superheated liquid layer adjacent to the heating surface. The result of the analysis is then applied to maximal heat transfer rates in pool boiling. (auth)

Refer also to abstracts 2790 and 2808.

MATERIALS TESTING

Refer to abstract 2644.

PUMPS

2699 AERE-Inf/Bib-93(3rd Ed.)

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

ELECTROMAGNETIC PUMPS AND FLOWMETERS. A

Bibliography. M. Greenhill. 1955. 5p.

Available unclassified reports from the Geneva Conference, the A.E.R.E., and the A.E.C. are listed in this bibliography. (D.E.B.)

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

2700 WADC-TR-54-194

Illinois. Univ., Urbana.

METAL BONDED ZIRCONIUM DIBORIDE. George Don McTaggart, Tracy A. Willmore, and Dwight G. Bennett. June 1954. 47p. Contract W33(038)-ac-14520. (AD-45691)

Zirconium diboride powders from two producers were combined with 20% by weight of either Co, Cr, Ni, or a mixture of Co plus Cr. Compacts and bars were formed using the techniques of powder metallurgy and fired in an A atmosphere at temperatures exceeding the melting point of the metals. A discussion of the phases present before and after firing, as determined by x-ray techniques, is presented. Photomicrographs showing fired porosity and microstructure of the specimens are discussed. Modulus of rupture determinations and tests for oxidation resistance at 2000°F were made. The mixtures tested were found to have only moderate strength. Their oxidation resistance was too low for them to be considered for use at 2000°F in oxidizing atmospheres. (auth)

2701

RECENT DEVELOPMENTS IN THE TECHNOLOGY OF CERAMIC MATERIALS FOR NUCLEAR ENERGY SERVICE. J. M. Warde and J. R. Johnson (Oak Ridge National Lab., Tenn.). *J. Franklin Inst.* **260**, 455-66(1955) Dec.

Recent developments in the technology of ceramic materials are reviewed. Data on uranium oxides are summarized. Thorium oxide is discussed as a potential breeder material. The fabrication of cermet is also briefly discussed. Radiation effects and corrosion of ceramics are reviewed. (B.J.H.)

CORROSION

2702 AECD-3704

Battelle Memorial Inst., Columbus, Ohio.

CONTINUED STUDIES OF CORROSION BY FUSED CAUSTIC. C. M. Craighead, L. A. Smith, E. C. Phillips, and R. I. Jaffee. Dec. 18, 1952. Decl. with deletions Oct. 4, 1955. 55p. Contract W-7405-eng-92.

Screening tests were made on a number of ceramic materials to determine their resistance to sodium hydroxide at 1000°F. The resistance of L-Nickel to sodium hydroxide at temperatures of 1000, 1250, and 1500°F has been investigated. It has been shown that the rate of attack of L-Nickel by molten sodium hydroxide increases with increasing temperature, and that the attack is less severe when reducing atmospheres are used above the

caustic than when a neutral atmosphere is used. At 1250 and 1500°F, solution and deposition of nickel under the influence of a temperature gradient was observed. This phenomenon is considered as limiting the use of nickel for containing sodium hydroxide to temperatures of about 1000°F. Analyses for nickel content of sodium hydroxide held in nickel containers at various temperatures indicated that, with a forming-gas atmosphere, the solubility did not change appreciably between 750 and 1250°F. The average nickel content over this temperature range did not exceed 0.003% nickel. At 1500°F, the solubility of nickel in sodium hydroxide is increased over that at lower temperatures. Limited data indicate that at 1250°F the solubility of nickel in sodium hydroxide is greater under an argon than under a forming-gas atmosphere. A study of addition agents to inhibit solution and deposition of nickel was made. Sodium carbonate additions were found to reduce deposition slightly; thus, it probably is not a detrimental impurity in sodium hydroxide. Sodium aluminate additions markedly reduced the solution and deposition of nickel at 1500°F. The optimum concentration of sodium aluminate was about 10 wt.%. Observations made during thermal-gradient stand-pipe tests indicate that the thermal conductivity of sodium hydroxide is lowered or the viscosity increased by the aluminate addition. (auth)

2703 BMI-793

Battelle Memorial Inst., Columbus, Ohio.
IDENTIFICATION AND GROWTH OF OXIDE FILMS ON ZIRCONIUM IN HIGH-TEMPERATURE WATER. C. M. Schwartz, D. A. Vaughan, and G. G. Cocks. Dec. 17, 1952. Decl. Oct. 18, 1955. 46p. Contract W-7405-eng-92.

This report presents a summary of a series of observations concerning oxide formation on zirconium and zirconium-tin alloys in 600°F water. The progress of corrosion has been followed microscopically, and by electron and x-ray diffraction. Three stages in the progress of corrosion can be described: the formation of a thin tetragonal oxide film coherent on the base metal, the transformation of the tetragonal to the monoclinic oxide, which grows at an accelerated rate but retains coherency with the substrate, and failure, by loss of coherency of the oxide and formation of white oxide. In the second stage, differences in the local character of corrosion were observed between good and bad zirconium. Two hypotheses have been proposed to account for the differences in corrosion rates of zirconium. (auth)

2704 NP-5852

Du Pont de Nemours (E. I.) & Co. Experimental Station, Wilmington, Del.

BORAX AND MERCAPTOBENZOTHAZOLE AS CORROSION INHIBITORS FOR WATER. Pt. II. (Memorandum Report No. 1612). E. H. Keller. Feb. 10, 1944. 5p.

Data are reported on the corrosion of copper by H₂O (with and without borax or mercaptobenzothiazole added). (C.W.H.)

2705 AEC-tr-2375

CORROSION OF ALUMINUM ALLOYS IN SUPERHEATED STEAM. L. Guillet and M. Ballay. Translated by K. S. Bevis from *Compt. rend.* 189, 551-3(1929). 3p.

The mechanism of corrosion of Al alloys in superheated steam is briefly reported and a comparison is made of the resistance of various commercial Al alloys to corrosion attack. (J.E.D.)

2706 AEC-tr-2379

THE ALODINE PROCESS, A NEW PROTECTIVE PROCESS FOR ALUMINUM AND ITS ALLOYS. A. Pollack. Translated by D. E. Cardamone from *Metall.* 5, 434-6(1951). 4p.

A study is made of the effectiveness of the "Alodine process" for the corrosion protection of Al and Al alloys against salt solutions, sea water, industrial air, and other strong attacking agents. (J.E.D.)

2707 AERE-Lib/Trans-555

THE CORROSION OF IRON BY BENZENE SOLUTIONS OF IODINE. L. G. Gindin and M. V. Pavlova. Translated by J. B. Sykes from *Zhur. Priklad. Khim.* 24, 1151-5(1954). 8p.

The corrosion of Fe in benzene solutions of I₂ produces FeI₂ which is converted into Fe₂O₃ by reaction with O₂. The conversion of FeI₂ into Fe₂O₃ stimulates the corrosion, and the accompanying liberation of I₂ makes the solution a continuously regenerated corrosive agent. (auth)

2708

NOMOGRAPH FOR CORROSION RATE CALCULATIONS. Henry K. Bass, Jr. and Robert V. Andrews (A & M College of Texas, College Station). *Corrosion* 12, 4t-5t (1956) Jan.

A nomograph which facilitates the determination of corrosion rate in mils per year is described. A typical problem involving calculation of corrosion rate is worked out on the accompanying nomograph. (auth)

2709

THE MECHANISM OF THE INHIBITION OF CORROSION BY THE PERTECHNETATE ION. II. THE REVERSIBILITY OF THE INHIBITING MECHANISM: G. H. Cartledge (Oak Ridge National Lab., Tenn.). *J. Phys. Chem.* 60, 28-32 (1956) Jan.

An attempt has been made to determine the extent to which the process responsible for the inhibition of corrosion by the pertechnetate ion is reversible. It has been found that the disturbance of inhibition by added electrolytes involves a specific action and not merely an increase in electrical conductivity of the solution phase. The electrode potential of electrolytic iron was measured both in potassium pertechnetate and in mixtures of this with other electrolytes. The potential was found to respond quickly to changes in the composition of the solution in a manner that clearly represented kinetic influences at the interface. It is concluded that the potential and the inhibition alike depend upon a labile state at the interface that is quickly responsive to changes in the composition of the solution. (auth)

2710

THE MECHANISM OF THE INHIBITION OF CORROSION BY THE PERTECHNETATE ION. III. STUDIES ON THE PERRHENATE ION. G. H. Cartledge (Oak Ridge National Lab., Tenn.). *J. Phys. Chem.* 60, 32-6(1956) Jan.

It has been shown that the perrhenate ion, ReO₄⁻, which is very similar to the pertechnetate ion, TcO₄⁻, in most respects, differs from it radically in failing to inhibit corrosion under aerated conditions. Radioactive Re¹⁸⁶ was used, in part, to eliminate the possibility that the radioactivity of technetium is involved in this difference. Measurements of the electrode potential of electrolytic iron in the presence of potassium perrhenate and sodium sulfate demonstrated the weakness of the ennobling effect of the perrhenate ion in aerated solutions and the greater susceptibility of this effect to competition with the sulfate ion, in comparison

with the ennobling effect of the pertechnetate ion. In the absence of air, no ennobling by the perrhenate ion was observed. The results are applied to a discussion of the hypothesis that interfacial polarizations arising from the internal charge distribution of the pertechnetate ion are the source of its action. (auth)

GEOLOGY AND MINERALOGY

2711 AERE-Lib/Trans-567

ON THE GEOMETRICAL METHODS OF QUANTITATIVE MINERALOGICAL ANALYSIS OF ROCKS. A. A. Glagolev. Translated by J. B. Sykes from Trans. Inst. Econ. Mineral. U.S.S.R. No. 59, (1933).

A study is made of the geometrical methods for quantitative analysis of minerals. The method makes it possible to obtain very quickly fairly exact results and in many cases makes it possible to replace a chemical analysis. The present work is intended to give some theoretical basis for a reliable determination of the error of measurement and even without apparatus simplifies the measurement and curtails the necessary time to one hour, for a probable error not exceeding 1%. (auth)

2712

ANALYTICAL ERROR AS A POSSIBLE CAUSE OF THE $t(206/238) > t(207/235) > t(207/206)$ AGE DISTRIBUTION. L. H. Ahrens (Oxford Univ., England). Geochim et Cosmochim Acta 8, 299(1955) Dec.

METALS AND METALLURGY

2713 AD-68680

Illinois. Univ., Urbana.

FATIGUE AND STATIC PROPERTIES OF WELDED JOINTS IN LOW ALLOY STRUCTURAL STEELS. (Civil Engineering Studies. Structural Research Series No. 90). G. E. Nordmark, J. E. Stallmeyer, and W. H. Munse. Jan. 14, 1955. 67p. Contract DA-33-017-eng-255.

Results are reported from an investigation of the fatigue and static properties of butt-welded joints in A-242 steel. Results are compared with those obtained from similar joints in A-7 steel. Four types of specimens were employed in the investigation. A plain plate specimen was selected to determine the fatigue properties of the base material, a tee fillet-welded joint was used to compare the fatigue properties of fillet welds deposited with E7016 electrodes on A-242 and A-5 steels, and longitudinal and transverse butt-welded joints were selected to study the fatigue and static properties of butt welds with the applied load parallel to and perpendicular to the direction of welding. Test procedures are described and results are tabulated. (C.H.)

2714 BMI-522

Battelle Memorial Inst., Columbus, Ohio.

THE TRANSFER OF IMPURITIES IN ZIRCONIUM PREPARED BY THE DE BOER PROCESS. H. H. Bulkowski, L. C. Beale, J. J. Sebenick, I. E. Campbell, and B. W. Gonser. Mar. 6, 1951. Decl. Nov. 15, 1955. 15p. Contract AT(30-1)-771.

The transfer of Fe, Ti, Al, N, C, Si, Ni, and Cr from the feed stock to the crystal bar by the de Boer process was studied. The feed materials were prepared by making

binary alloys of these elements with iodide-deposited Zr from the de Boer bulb. High-carbon sponge Zr and high-temperature vacuum-sintered sponge Zr also were used in the experiments described. Noncorrodible Zr also was used as feed stock to determine the effect of redeposition on the purity and corrodibility of the product. Several runs produced Zr of good corrosion resistance, and the purity of the product was essentially the same as that of the starting material. Experiments showed that the rate of deposition of Zr and the transfer of impurities were not affected by the iodine concentration. (auth)

2715 BMI-776

Battelle Memorial Inst., Columbus, Ohio.

A STUDY OF THE STRENGTHENING OF THORIUM BY ALLOYING, COLD WORK, AND AGING. R. M. Goldhoff, H. R. Ogden, and R. I. Jaffee. Nov. 1, 1952. Decl. Sept. 30, 1955. 44p. Contract W-7405-eng-92.

Information about the strengthening mechanisms for thorium has been obtained using iodide thorium as a base. Of the possible interstitial solutes, only carbon has a marked effect on the mechanical properties of iodide thorium. The yield strength and ultimate strength are about tripled by the addition of 0.25% carbon. When the same amount of impurities other than carbon normally found in Ames thorium are added to iodide thorium, they have little effect on mechanical properties. The independent effects of cold working and age hardening as a means for strengthening thorium are discussed. Thorium alloys with high strength and adequate ductility can be developed by the proper combination of cold working and aging. (auth)

2716 BMI-900

Battelle Memorial Inst., Columbus, Ohio.

THERMAL CONDUCTIVITY AND LINEAR EXPANSION OF THE EUTECTIC URANIUM-CHROMIUM ALLOY. H. W. Deem, R. A. Winn, and C. F. Lucks. Jan. 29, 1954. Decl. Sept. 30, 1955. 16p. Contract W-7405-eng-92.

Measurements of linear thermal expansion and thermal conductivity were made from 20 to 800°C on the uranium-chromium eutectic alloy (nominal composition 5.2 w/o chromium). Mean linear expansion coefficients, 10^{-6} per deg C, for 13 specimens are: 17.9 in the alpha phase, 23.0 in the beta phase, 26.1 in the gamma phase, and 24.7 over the range from 20°C through the beta-gamma transformation. Average thermal conductivities range from 0.069 cal/(sec)(cm)(C) at 0°C to 0.111 cal/(sec)(cm)(C) at 800°C. (auth)

2717 GEAP-0500

General Electric Co. Atomic Products Div., Schenectady, N. Y.

INVESTIGATION OF STAINLESS STEEL-CARBON STEEL COMPOSITE TUBES. C. H. Saums and C. H. Kreischer. May 1955. 39p.

A preliminary investigation was made to determine the feasibility of using extruded composite tubing in heat exchanger design. Tests were run to determine the reliability of the bond between the metals and to find the linear coefficient of thermal expansion. It was also desired to establish a reasonable method of welding relatively thin-walled tubes into a heavy tube sheet. Results indicate that extruded composite tubing has a good bond. The linear coefficient of thermal expansion of the sample tested was 7.31×10^{-6} in. in-degrees F. Analysis shows this coefficient to be a function of the ratio of the thicknesses of the two metals. Metallurgically sound welds were produced

between the subject tubes and tube sheets of both type 347 stainless steel and AISI 1035 carbon steel. The most promising results were obtained with stainless steel by using the tungsten inert arc welding process with a trepanned weld preparation. No filler was used on the first weld pass. (auth)

2718 HW-39805

Hanford Atomic Products Operation, Richland, Wash.
IRRADIATION OF ZIRCALOY-2 IMPACT SPECIMENS CONTAINING HYDROGEN. R. G. Wheeler and W. S. Kelly. Nov. 2, 1955. 6p. Contract W-31-109-Eng-52: \$1.80(ph OTS); \$1.80(mf OTS).

An integrated exposure of 1.9×10^{18} nvt at 150 to 200°C in a pressurized water loop running through the central zone of a Hanford pile caused no detectable pick-up of H in Zircaloy-2 specimens located both in and out of the central flux zone. Hydrogen in the Zircaloy-2 in excess of 100 ppm did not accelerate H absorption under these conditions by a detectable amount. The Charpy V notch impact energy transition temperature of the irradiated Zircaloy-2 containing 125 ppm H was 35°C higher than identical specimens that were also exposed in the loop but out of the pile flux. The impact energy absorption of the low H material was essentially unaffected by irradiation. (auth)

2719 ISC-377

Ames Lab., Ames, Iowa.

MAGNESIUM-URANIUM ALLOY SYSTEM. George A. Tracy, P. Chiotti, and H. A. Wilhelm. June 1953. Decl. Sept. 8, 1955. 55p. Contract W-7405-eng-82.

This report was declassified with deletions July 16, 1954, and issued as AECD-3635.

Analytical, x-ray, thermal, and metallographic data have been obtained in the study of the Mg-U system, and a proposed phase diagram has been constructed. Almost complete liquid immiscibility was found at temperatures up to 1255°C, and the compositions of the two liquids which coexist under a pressure of about 3 atmospheres at about 1150°C are approximately 0.16% by weight U in Mg and 0.004% Mg in U. The solubility of U in Mg decreases to nearly 0.05% at 675°C and to about 0.0005% at 650°C. It was found that U has little or no effect on the melting point of Mg. The Mg does not affect the U transformation temperatures sufficiently for detection by the methods employed. X-ray data show that the diffusion bands formed at the U-Mg interface when U was heated in contact with Mg contained in a graphite crucible are composed of UC and UC₂. X-ray-diffraction patterns have also shown the presence of U₃Si₂ and USi in U heated in contact with Mg contained in a "Magnorite" crucible which contained a percentage of Si as an impurity. Methods and apparatus which are suitable for the preparation of alloys of reactive metals under an inert atmosphere are discussed. A heating chamber which was used to prepare alloys under pressures of 3 to 4 atmospheres is shown. Crucibles made of several ceramic materials were found to be reactive or porous toward U and Mg. Crucibles made from high purity Mg containing 10% by weight of added Mg fluoride were found to be nonporous and non-reactive toward Mg-U melts. (auth)

2720 ISC-463

Ames Lab., Ames, Iowa.

SOLUBILITY OF CARBON IN THORIUM. Robert Mickelson and David Peterson. Feb. 18, 1954. Decl.

Sept. 8, 1955. 15p. Contract W-7405-eng-82.

The solubility of C in Th has been investigated and the limit of solubility has been determined at four temperatures. Thorium-carbon samples, containing from 0.025 to 1.23 wt.% C, were prepared by arc melting sponge Th with high purity graphite. X-ray data, hardness readings, and metallographic examinations of heat treated specimens were combined to obtain the following solubility limits: room temperature -0.35% C, 800°C-0.43% C, 1018°C-0.57% C, and 1215°C-0.91% C. (auth)

2721 NACA-TN-3552

Langley Aeronautical Lab., Langley Field, Va.

INVESTIGATION OF THE COMPRESSIVE STRENGTH AND CREEP LIFETIME OF 2024-T3 ALUMINUM-ALLOY PLATES AT ELEVATED TEMPERATURES. Eldon E. Mathauser and William D. Deveikis. Jan. 1956. 40p.

Results of elevated-temperature compressive-strength and creep tests of 2024-T3 (formerly 24S-T3) aluminum-alloy plates supported in V-grooves are presented. The strength-test results indicate that a relation previously developed for predicting plate compressive strength at room temperature is satisfactory for determining elevated-temperature strength. Creep-lifetime results are presented for the plates in the form of master creep-lifetime curves by using a time-temperature parameter that is convenient for summarizing tensile creep-rupture data. The use of time-dependent stress-strain curves obtained from plate-creep curves for predicting plate-creep failure stresses is investigated. (auth)

2722 NACA-TN-3600

Langley Aeronautical Lab., Langley Field, Va.

CORRELATION OF CRIPPLING STRENGTH OF PLATE STRUCTURES WITH MATERIAL PROPERTIES. Roger A. Anderson and Melvin S. Anderson. Jan. 1956. 50p.

A correlation approach to the crippling-strength analysis of plate structures in new materials and at elevated temperatures is presented. Appropriately defined crippling-strength moduli and correlation procedures are given for predicting the effect of a change in material properties on the strength of a structure. The strength moduli are readily calculated from the effective compressive stress-strain curve for the structural material. The correlation procedures are applicable to multiplate-element components and the accuracy is illustrated with available experimental data obtained in various materials and under different temperature conditions. (auth)

2723 NP-5864

Case Inst. of Tech., Cleveland.

THE EFFECT OF BRITTLE SKINS ON THE DUCTILITY OF METALS. Technical Report No. 33 [on] THE EFFECTS OF STRESS CONCENTRATION AND TRI-AXIALITY ON THE PLASTIC FLOW OF METALS. G. Willy Form and W. M. Baldwin, Jr. Dec. 1955. 27p. Project NR-081-049. Contract N6-ONR-273/I.

Brittle skins (e.g., carburized cases) embrittle an otherwise ductile metal to a greater degree than would be anticipated by the percentage of bulk that the skin occupies. Evidence is adduced to show that in tensile tests on metals with brittle skins, the skin cracks at a negligible strain, and from this point on the test is merely a notch tensile test of the core. This points out, among other things, that notch sensitive steels are ill-suited for carburizing purposes. (auth)

2724 NP-5866

Lehigh Univ., Bethlehem, Penna. Inst. of Research.
THE INVESTIGATION OF THERMAL AND ELECTRICAL PROPERTIES OF METALS AT HIGH TEMPERATURE.
 Final Report. Raymond B. Sawyer. Dec. 31, 1955. 32p.
 DA Project No. 599-01-004. Contracts DA-36-034-ORD-506 and DA-36-034-ORD-1475.

The measurement of thermal and electrical conductivities of Bi and Bi-Pb alloys above and below room temperature, measurement of specific heat, the theory of thermal and electrical conductivities, heat transfer through gas-powder mixtures, and thermal conductivity of SAE 1010 steel are discussed. A description of the Forbes bar method for the analysis of the temperature distribution in a two-medium composite cylinder during thermal conductivity measurements is given. (For preceding period see NP-5790.) (J.E.D.)

2725 NRL-4677

Naval Research Lab., Washington, D. C.
PROCEDURES FOR RISERING STEEL CASTINGS. H. F. Bishop and W. H. Johnson. Nov. 23, 1955. 19p. Project Nos. NR-642-030 and NS-014-100.

The applications of rules for scientifically rising steel castings, are shown for several commercial type castings. Cases are shown where riser locations are determined using formulas for riser feeding range in uniform sections, feeding range in heavy and light parent-appendage combinations, and the application of chills to increase riser feeding range. Procedures for the calculation of minimum riser dimensions for these castings are shown; these include cases where single and multiple risers are required, and where thin sections are joined to heavy sections. (auth)

2726 TID-3010(Suppl.2)

Technical Information Service, AEC.

ZIRCONIUM: A BIBLIOGRAPHY OF UNCLASSIFIED REPORT LITERATURE. Hugh E. Voress and Thomas W. Scott, comps. Sept. 1955. 41p.

This supplement contains 228 annotated references to unclassified reports on Zr which were available for review at the TIE from Mar. 15, 1953 to Sept. 20, 1955. Author, subject, and report number indexes are included. (auth)

2727 TID-3044(Suppl.1)

Mound Lab., Miamisburg, Ohio and Technical Information Service, AEC.

THORIUM: A BIBLIOGRAPHY OF PUBLISHED LITERATURE. W. D. Prater, E. F. Joy, and E. G. Esterbrook, comps.—Robert E. Allen, ed. June 1955. 299p.

This supplement to TID-3044 contains annotated references to published literature which appeared in Chemical Abstracts from 1906 to 1952. Author and subject indexes are included. (auth)

2728 TML-25

Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.

BETA TRANSFORMATION IN TITANIUM ALLOYS. F. C. Holden and R. I. Jaffee. Dec. 5, 1955. 137p. Contract AF-18(600)-1375.

A survey has been made of the literature on the four types of beta transformation encountered in alpha-beta Ti alloys. The present state of knowledge regarding the mechanism and reaction kinetics of these transformations

has been summarized in the text and a considerable amount of experimental data are included in the appendixes. The relationships existing between these transformations and the problems of heat treatment and thermal stability of Ti alloys are discussed. (auth)

2729 TML-27

Battelle Memorial Inst., Columbus, Ohio. Titanium Metallurgical Lab.

EFFECT OF HYDROGEN ON THE PROPERTIES OF TITANIUM AND TITANIUM ALLOYS. G. A. Lenning and R. I. Jaffee. Dec. 27, 1955. 111p. Contract AF 18(600)-1375.

The effect of hydrogen on mechanical properties of titanium materials is somewhat unique in that two fundamentally different types of embrittlement have been observed. The first type of embrittlement has been shown to be a classical transition behavior in which the precipitation of the brittle hydride phase increases the sensitivity to high testing speeds and notches. The second type of embrittlement has been shown to occur through a strain-aging mechanism. This embrittlement becomes most severe at slow testing speeds and low temperatures. (auth)

2730 WADC-TN-55-501

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

MECHANICAL PROPERTY TESTS FOR HYDROGEN CONTAMINATED ALPHA-BETA TITANIUM ALLOYS. H. M. Burte. Sept. 6, 1955. 15p. Project No. 73510.

Data on the effects of hydrogen contamination on the room-temperature mechanical properties of α - β titanium alloys are summarized. Mechanical-property tests are discussed for determining whether an alloy is susceptible to embrittlement due to its hydrogen content. (auth)

2731 WADC-TR-52-289

Wright Air Development Center. Components and Systems Lab., Wright-Patterson AFB, Ohio.

A COMPARATIVE STUDY OF THE ELECTRICAL CONTACT PROPERTIES OF TITANIUM. Samuel Jurich. Feb. 1952. 74p. (AD-2178)

Electrical contact properties of commercially pure titanium have been compared to those of Cu, Al, and steel. To determine the relative effect of heat and moisture on Ti when used with dissimilar metals, a comparative study of Ti, Cu, Al, and steel was undertaken. Various assemblies of bolts, washers, nuts, terminals, and rivet-terminal combinations were mounted on a panel of each of the metals and were then subjected to high humidity for a three-month period. Suitable terminal combinations for each type of metal were found. More contact assemblies proved unsuitable when used on titanium than when used on the other metals which were tested. Results indicated that care should be exercised in the selection of combinations of metals to be used to electrically connect wire to titanium chassis or panels. In most cases, initial resistance values of titanium were higher than those of other metals which were tested, but the difference in resistance value of titanium decreased materially as the test proceeded. (auth)

2732 WADC-TR-53-510(Pt.I)

Minnesota. Univ., Minneapolis.

DYNAMIC CREEP, STRESS-RUPTURE, AND FATIGUE PROPERTIES OF 24S-T4 ALUMINUM AT ELEVATED

TEMPERATURES. PART I. UNNOTCHED SPECIMENS. Fred W. De Money and Benjamin J. Lazan. March 1954. 51p. Contract AF-33(038)-20840. (AD-36901)

Fatigue, stress-rupture, and creep data obtained under various combinations of mean and alternating axial stress are presented and discussed for rolled aluminum alloy 24S-T4 at 300 and 500°F. The data are presented as S-N curves and stress range diagrams to show the effect of temperature, alternating-to-mean load ratio, and stress magnitude on the fatigue, stress-rupture, and creep properties. The effect of temperature and alternating-to-mean ratio on the characteristics of the creep curve is discussed on the basis of "static" and "dynamic" types. The role of both creep and fatigue as factors in rupture is discussed with particular reference to temperature and alternating-to-mean ratio. (auth)

2733 WADC-TR-55-112

General Electric Co. Research Lab., Schenectady, N. Y. **THE DEFORMATION OF POLYCRYSTALLINE MAGNESIUM-ALUMINUM ALLOYS.** R. Lenhart. May 1955. 34p. Project title: METALLIC MATERIALS. Task title: DEFORMATION MECHANISMS OF METALS. Contract AF 33(616)-2120.

The tensile and compression flow characteristics of a series of magnesium-aluminum alloys were measured. In single-phase alloys twinning was found to be profuse in specimens deformed by a compression test and almost absent in specimens deformed by tensile testing. The presence of precipitate particles in the high aluminum alloys greatly restricts the formation and growth of twins under compression. (auth)

2734 WAL-401/244

Watertown Arsenal Labs., Mass. **GRAIN GROWTH OF TITANIUM AND TITANIUM ALLOYS AT NORMAL HOT-WORKING TEMPERATURES.** Frank R. Larson. Aug. 2, 1955. 17p. Project title: MATERIALS FOR LIGHT WEIGHT CONSTRUCTION.

Four titanium alloys (RC-55, RC-70, RC-130A, and RC-130B) have been studied to determine grain growth characteristics at normal hot-working temperatures. It was found that two separate and distinct grain growth rates exist, namely, one for the α -plus- β duplex structure and one for the single-phase all- β structure. (auth)

2735 WCRT-TN-54-51

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio. **THERMAL PROPERTIES OF ALUMINUM AND TITANIUM ALLOYS.** John J. Murnin. Mar. 1954. 20p. (AD-51791)

The specific heats, thermal conductivity, and linear expansion coefficients of Al alloys 24S-T4 and 76S-T6 and the linear expansion coefficients of various Ti alloys are tabulated. (auth)

2736 Y-1052

Carbide and Carbon Chemicals Co. Y-12 Plant, Oak Ridge, Tenn.

INVESTIGATIONS OF ANALYSES OF ZIRCONIUM HYDRIDE AND ZIRCONIUM OXIDE FOR BORON. H. G. King and C. B. Burnette. Sept. 12, 1952. Decl. Oct. 4, 1955. 17p. Contract W-7405-eng-26.

Acid or fusion decompositions of ZrH_4 and ZrO_2 to allow separation of B as trimethyl borate were studied. Decomposition was successful with refluxing H_2SO_4 , and

partly successful with Na_2SO_4 melts. Loss of B during conversion of ZrH_4 to ZrO_2 was indicated during a study of the ignition conditions, and shown conclusively by spectrographic examination of the off-gases. Contamination of the sample material by boron from new platinum ware was also found. Agreement of spectrochemical and curcumin colorimetric determinations of boron zirconium hydride was fairly good, but both methods lacked precision. The low precision may be attributable to inhomogeneity of the sample material. (auth)

2737 AEC-tr-2377

DETERMINATION AND FORMATION OF OXIDE LAYERS ON ALUMINUM. W. D. Treadwell and A. Obrist. Translated by K. S. Bevis from *Helv. Chim. Acta* 26, 1816-28 (1943). 13p.

The separation of oxide from aluminum by dissolving away the metal with ether-HCl was investigated and a decomposing apparatus was developed, which operates on the principles of a Soxhlet extractor, so that the ether constantly contained in the apparatus distills back and the HCl is introduced from a cylinder. Thin eloxal layers, produced with accurately measured amounts of current, were specified as a control for the method. In the determination of natural oxide layers on aluminum, a comparison was made between this method and the bromine-methanol process. Results of both methods were in agreement. Results of oxide determinations on new Raffinal turnings are given. The oxidizability of aluminum foil in dry oxygen was measured at a temperature range of 250 to 600°C and in dry ozone at room temperature as a function of time. (auth)

2738

PHYSICAL AND X-RAY STUDY OF THE DISILICIDES OF TITANIUM, ZIRCONIUM, AND HAFNIUM. Perry G. Cotter, J. A. Kohn, and R. A. Potter (Bureau of Mines, Norris, Tenn.). *J. Am. Ceram. Soc.* 39, 11-12 (1956) Jan.

A method of preparing the disilicides of titanium, zirconium, and hafnium is outlined. Unit-cell dimensions, density, Knoop microhardness numbers, chemical analyses, and solubility in various reagents are given for the three compounds. It is concluded that these disilicides have no value as industrial hard materials. (auth)

2739

ON THE THERMAL ASPECT OF FATIGUE. A. M. Freudenthal and J. H. Weiner (Columbia Univ., New York). *J. Appl. Phys.* 27, 44-50 (1956) Jan.

An attempt is made to show that the highly localized temperature and associated thermal stress gradients in front of active slip planes, resulting from the conversion into heat of the work in slip of the resolved shear stress, are of sufficient severity to account for the initiation of micro-cracks parallel to the slip planes if, as in fatigue, slip under repeated stress cycles is concentrated into "striations." The effect of the thermal characteristics of the metal on its fatigue performance is discussed. (auth)

2740

THE PRESENT STATUS OF TITANIUM DEVELOPMENT. D. J. McPherson (Armour Research Foundation, Chicago). *J. Metals* 8, 23-30 (1956) Jan.

A general discussion of the status of Ti development is presented covering the alloy development, heat treatment, production quality, large scale handling and processing and sponge preparation. (J.E.D.)

2741

STATUS OF TITANIUM FABRICATION AND USE. J. H. Garrett (U. S. Dept. of Defense, Washington, D. C.). J. Metals **8**, 30-5(1956) Jan.

2742

THE FUTURE USE PATTERN FOR TITANIUM. B. S. Mesick (Arthur D. Little, Inc., Cambridge, Mass.). J. Metals **8**, 42-8(1956) Jan.

A brief review is presented of the production of Ti and the status and future prospect for its use in industry. (J.E.D.)

2743

INTERACTION BETWEEN METALS AND ATMOSPHERES DURING SINTERING. John T. Norton (Massachusetts Inst. of Tech., Cambridge). J. Metals **8**, 49-53(1956) Jan.

A study was made of the various types of interaction between metals to be sintered and the atmosphere which surrounds them, depending upon whether the phenomena are essentially chemical or physical in nature. (auth)

2744

EXAMINING IRRADIATED FUELS UNDER WATER. Henry J. Bellarts, John L. Spencer, and Roy S. Peterson (Hanford Atomic Products Operation, Richland, Wash.). Nucleonics **14**, No. 1, 30-3(1956) Jan.

An underwater facility is described which consists of a primary inspection station, equipment for cleaning slugs, and a dejecter, where the Al can is removed from the U. The facility is designed to examine 128 slugs per 8-hr shift. The equipment and procedures are described and illustrated, and the advantages of underwater facilities over hot cells are summarized. (M.P.G.)

2745

CARBON STEEL PROMISES CHEAPER REACTOR SYSTEMS. R. U. Blaser and J. J. Owens (Babcock and Wilcox Co., Alliance, Ohio). Nucleonics **14**, No. 1, 68-71 (1956) Jan.

The corrosion of carbon steel in water has been investigated, and results are summarized. No insurmountable problems in the use of carbon steel in high-purity water were found. It is believed that sufficient information is available to permit design of a carbon-steel reactor system at this time. (M.P.G.)

2746

PROPERTIES OF INDIUM AND THALLIUM AT LOW TEMPERATURES. C. A. Swenson (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. **100**, 1607-14(1955) Dec. 15.

The pressure-volume relationships for superconductors near absolute zero are of potential interest for comparison with theories which attempt to explain the variation of the superconducting transition temperature with pressure. Such data for thallium are of special interest since the variation of transition temperature with pressure is different for thallium than for any other known pure metal. In these experiments, measurements on indium of the total compression to 10,000 atmos for various temperatures down to 4.2°K served as a check of similar measurements on thallium. No unusual behavior was found for either metal. These results were combined with the measurement of the total thermal expansions for both metals to give isobars at both zero pressure and at 10,000 atmos pressure over the range from 4.2° to 300°K. The results of some low-temperature compressive testing experiments on both metals are also given, together with some indirect evidence as to

the vanishing of work hardening effects at low temperature and moderate hydrostatic pressures. Finally, measurements on the electrical resistance of indium show an unexplained kink in the R vs. T curve at about 210°K. The effect of the electrical resistance of indium due to tensile (plastic) deformation at 4.2°K was also measured. (auth)

2747

EFFECT OF ANTIMONY IMPURITY ON SELF-DIFFUSION OF SILVER. E. Sonder (Univ. of Illinois, Urbana). Phys. Rev. **100**, 1662-6(1955) Dec. 15.

Coefficients for diffusion of Ag¹¹⁰ into single crystals of alpha silver antimony were measured as a function of temperature and concentration, over the range 550 to 900°C and 0 to 1½% antimony concentration. In addition, a number of measurements were made of the diffusion of Sb¹²⁴ into similar alloys. The activation energy for silver self-diffusion was found to decrease by 1½ kcal per percent added antimony. Effects of impurity were appreciably less for solute diffusion than for solvent diffusion. The results are in qualitative agreement with theories of Overhauser and Lazarus, and indicate that effects due to changes in vacancy concentration are smaller than those resulting from changes in mobility energy. (auth)

Refer also to abstracts 2633, 2705, 2919, 2956, and 2965.

PHYSICS**2748 ANL-4743**

Argonne National Lab., Lemont, Ill.
OPACITY CALCULATIONS FOR LIGHT ELEMENTS AND MIXTURES. S. A. Moszkowski and R. E. Meyerott. Oct. 1951. Decl. Nov. 2, 1955. 64p. Contract W-31-109-Eng-38.

Tabular and graphic results of light element opacity calculations are given. The method of calculation is discussed and compared with a method of approximation in which the Gaunt factors are assumed constants. The method of approximation is found to simplify opacity calculations for light elements at high temperatures. (D.E.B.)

2749 DOW-82

Dow Chemical Co. Western Div., Pittsburg, Calif.
COST OF COOLING PHOSPHORIC ACID IN A 174 GPM SOLVENT-EXTRACTION PLANT. J. F. Valle-Riestra. July 23, 1952. Decl. Sept. 29, 1955. 14p. Contract AT-30-1-GEN-236.

The cost of two cooling units, an evaporative cooler and a spray cooler, to precool a 174 gpm stream of 28.5% P₂O₅ acid from 70 to 40°C is compared. Use of the evaporative cooler would increase the unit cost of U₃O₈ recovered from a 174 gpm solvent-extraction plant by \$1.70/lb., with an investment of \$292,000. Use of the spray cooler would increase the U₃O₈ unit cost by \$1.08/lb., with an investment of \$158,000. On this basis, use of the spray cooler is recommended. (auth)

2750 IDO-16076

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
GAMMA INTENSITIES IN THE MTR GAMMA IRRADIATION FACILITY. T. R. Wilson, Jr. [Mar. 6, 1953?]. Decl. Sept. 12, 1955. 14p. Contract [AT(10-1)-205].

The γ irradiation facility consists of a rectangular

array of irradiated MTR fuel assemblies with an unoccupied space into which materials to be irradiated may be placed. Preliminary measurements of the intensity of the γ field in the center of the facility have been conducted using chemical dosimetry techniques. Since a source of sufficient strength was not available for calibration of the dosimeters, the accuracy and reliability of the measurements are uncertain. However, the measured values agree closely with the calculated results. (M.P.G.)

2751 NOL-CORONA-143

Naval Ordnance Lab., Corona, Calif.
COMPUTING MACHINE COMPONENTS PROGRAM.
Quarterly [Progress] Report [No. 6] for October–December 1953. May 1954. 52p.

The effects of hydrogen annealing on Permalloy films is discussed. Hysteresis loops of Permalloy films are shown before and after annealing. Some of the evaporated films were produced with square hysteresis loops. A general discussion is given of leakage in magnetic cores and applications of the cores. Circuit diagrams are given of elements of a 25-Mc serial storage loop and a 25-Mc clock oscillator. A general discussion is given of parallel adders. (For preceding period see NBS-1245.) (B.J.H.)

2752 NOL-CORONA-252

Naval Ordnance Lab., Corona, Calif.
COMPUTING MACHINE COMPONENTS PROGRAM
QUARTERLY REPORT NO. 8 [FOR] APRIL–JUNE 1954.
Apr. 1955. 41p.

By using soft glass substrates which have a coefficient of thermal expansion compatible with a metal film, it has been possible to deposit thick films. A microcolorimetric analytic technique has been developed for the Fe–Ni system. Some information on uniformity of film production is discussed. The theory of magnetization reversal by domain rotation has been developed. The ferroelectric properties of BaTiO_3 single crystals are summarized. Representative hysteresis loops and polarization reversal transients of these crystals are shown. Logical schematic diagrams, circuit diagrams, and wave forms for a dynamic flip-flop, a 10-Mc pulse storage loop, and a pulse burst generator are given. The magnetization reversal time of ferrites is briefly discussed. (For preceding period see NOL-CORONA-151.) (B.J.H.)

2753

CADMIUM SULFIDE WITH SILVER ACTIVATOR. John Lambe (U. S. Naval Research Lab., Washington, D. C.).
Phys. Rev. 100, 1586–8(1955) Dec. 15.

Further experimental evidence is presented in connection with a model which has been proposed by Lambe and Klick for $\text{CdS}(\text{Ag})$. In this model, the silver activator is assumed to give rise to a level which is approximately 0.4 eV below the conduction band, and that luminescence occurs when an electron in such an activator level recombines with a free hole. It is shown that irradiation in the 1μ infrared region stimulates luminescence by generating free holes, while also causing well known quenching effects in photocurrent. It is also shown that 3μ irradiation gives rise to photoconduction by exciting electrons from the activator levels into the conduction band. The proposed model indicates that irradiation in the 3μ region should quench luminescence by removing electrons from activator levels, and this is found experimentally. These experiments further substantiate the proposed model for $\text{CdS}(\text{Ag})$. (auth)

2754

THE LIQUID 'CELL' MODEL APPLIED TO ^3He . H. N. V. Temperley (U. S. National Bureau of Standards, Washington, D. C.). *Proc. Phys. Soc. (London)* A68, 1136–44(1955) Dec. 1.

It is shown that a sum of suitably chosen Debye and Schottky functions leads to a Gibbs free energy that satisfactorily represents the entropy, specific heat, and vapor pressure of liquid He^3 . It is further shown that such a free energy is a plausible consequence of the 'cell' model of the liquid. The model can be developed consistently with symmetry requirements by using the 'pair-wise' approximation of the Heitler–London–Heisenberg theory of ferromagnetism, in a way that enables the magnetic susceptibility to be described quantitatively. The model predicts that the lowest state of liquid He^3 is an antiferromagnetic one of zero entropy, and that a transition should occur at 0.1° to 0.2°K . A comparison is made with the 'imperfect Fermi gas' model considered earlier, which, although it can be further improved in various ways, seems to be inferior to the present one. (auth)

2755

IRON CATALYST FOR PRODUCTION OF LIQUID PARA-HYDROGEN. D. H. Weitzel and O. E. Park (National Bureau of Standards, Boulder, Colo.). *Rev. Sci. Instr.* 27, 57–8(1956) Jan.

Liquid normal hydrogen has been converted to >90% para-hydrogen by passing it through a catalytic bed of ferric hydroxide gel. Particle size has a decided effect on catalyst effectiveness. (C.W.H.)

2756

THE ISOLATING TUBE. XVI. PRODUCTION OF Xe^{136} . K. Clusius, H. H. Bühler, H. Hürzeler, and E. Schumacher (Univ. of Zurich, Switzerland). *Z. Naturforsch.* 10a, 809–14(1955) Nov. (In German)

Filling a light source for the emission of normal wave lengths of the most extreme resolution, with pure elements of even mass and even atomic number provides a light source without hyperfine structure. Under similar conditions the Doppler width of the line becomes so small, that larger M/T values are attainable by the assumed vapor pressure. Liquid-air-cooled krypton sources containing Kr^{84} or Kr^{86} are superior in this regard to Hg^{198} light sources. In order to study the characteristics of the most favorable xenon lamp, 1.35 g, of 99% purity, of Xe^{136} were isolated in the 48 m tube. (tr-auth)

AEROSOLS

Refer to abstract 2828.

ASTROPHYSICS

Refer to abstract 2908.

COSMIC RADIATION

2757 NP-5859

Minnesota. Univ., Minneapolis.
THE VELOCITY SPECTRUM OF COSMIC RAY PARTICLES AT THIRTEEN GRAMS ATMOSPHERIC DEPTH (thesis).
E. Nelson Mitchell. 1955. 74p. Cosmic Ray Project.
Contract N6onr-246.

Two balloon flights have been made at geomagnetic latitude of 55° carrying a Čerenkov detector whose mean pulse height is velocity dependent and is thus capable of providing an independent check on the velocity spectrum at this latitude. The Čerenkov detector was operated in coincidence with a Geiger counter telescope on both flights, and the detector was surrounded by a ring of guard counters on the second flight. An experimental measurement of the dependence of the pulse height distribution on velocity for this detector, made in the π^- beam of the Chicago cyclotron, has been used to calibrate this detector. It was found that the detector performed approximately, but not entirely, as Čerenkov theory predicts. On the first flight, data was gathered which made it possible to examine the variation of the shape and position of the pulse height distribution with altitude. From this study, qualitative information was obtained concerning the nature of the transition of the primary flux as it passed down through the atmosphere. On the second flight data was collected at thirteen millibars which gave quantitative information on the primary flux and the total flux at that altitude. A velocity spectrum was obtained which indicated that two-thirds of the particles at thirteen grams must be attributed to secondaries or primaries other than protons if the assumptions of the geomagnetic theory are to be maintained. Using the geomagnetic theory, a primary proton flux value of $0.11/\text{cm}^2\text{-ster-sec}$ and primary alpha flux of $0.025/\text{cm}^2\text{-ster-sec}$ was obtained. (auth)

2758 NP-5860

Minnesota. Univ., Minneapolis.

ČERENKOV COUNTER MEASUREMENT OF MULTIPLY CHARGED COSMIC RAYS. John Linsley. 1956. 36p. Cosmic Ray Project. Contract N6onr-246.

Measurements have been made on the charge spectrum of cosmic rays at geomagnetic latitude 41° . The value 88 ± 8 particles/ $\text{m}^2\text{sec sterad}$ was found for the primary alpha particle flux. For the flux of nuclei with $6 \leq Z \leq 8$, the value 7.4 ± 1.7 particles/ $\text{m}^2\text{sec sterad}$ was found, and for the $Z \geq 9$ flux, the value 4 ± 2 . It is most probable that all of the Li, Be, and B nuclei observed were secondary. The experiment sets an upper limit 0.25 on the abundance of primary Li, Be, and B relative to the medium elements ($6 \leq Z \leq 10$). The data were obtained during balloon flights at a level of 16 g/cm^2 . Events selected by a Geiger counter telescope were measured with a Čerenkov detector, and a record was kept of the pulse heights. When the pulse was greater than two relativistic protons would produce, a cloud chamber above the Čerenkov detector was triggered. In that way 394 events were photographed. Often the photographs showed the track of an unaccompanied multiply charged particle traversing the telescope. The corresponding pulse height then served to determine the particle's charge. These experiments are concerned with the integrated flux of cosmic α particles for energy greater than 1.75 Bev/nucleon , that being the cutoff energy for α particles at 41° geomagnetic latitude. (auth)

2759

THE GEOMAGNETIC LATITUDE EFFECT ON THE NUCLEON AND MESON COMPONENT OF COSMIC RAYS AT SEA LEVEL. D. C. Rose and J. Katzman (National Research Council, Ottawa, Canada). *Can. J. Phys.* 34, 1-19 (1956) Jan.

Measurements have been taken on the changes in intensity

of the nucleon and meson components of cosmic rays. The geomagnetic latitudes covered extend from 18° to 89°N . The latitude knee is clearly shown at a geomagnetic latitude of about 52° in the case of the nucleon component and less definitely between 40° and 50° in the case of the meson component. The rigidity of particles arriving in a vertical direction at 52° is 2.1 Bev and at 45° is 3.7 Bev . Meyer and Simpson have shown that changes in the primary spectrum between 1948 and 1954 probably extend up to these rigidities and such changes should, therefore, be observable at sea level. The longitude effect at low latitudes is clearly shown by differences in intensity between the measurements on the east and west sides of North America. In the case of the meson component, the magnitude of the longitude effect at these longitudes was found to be greater than that shown by Millikan and Neher in 1936. The interpretation of the meson component results above the knee is complicated by difficulties in temperature correction. In the case of the nucleon component, an apparent longitude effect exists above the knee in that there was a small difference in the intensity at high latitudes in the eastern and western parts of the North American Arctic. No satisfactory explanation is offered for this. The diurnal variation of the nucleon component at high latitudes is shown but no unusual features were found. (auth)

2760

OBSERVATIONS ON STARS AND HEAVY PRIMARIES RECORDED IN EMULSIONS FLOWN IN VIKING ROCKET NO. 9. Herman Yagoda (National Institutes of Health, Bethesda, Md.). *Can. J. Phys.* 34, 122-46 (1956) Jan.

Methods for the preparation of fresh nuclear emulsions for use in the study of cosmic radiation by rocket exposures are described. Shattering and mechanical damage is minimized by substituting transparent plastics for the glass support. By tamping the emulsion on a temporary microporous medium such as plaster of Paris, emulsions 2 mm thick can be dried in about six days without appreciable loss of sensitivity. Strong, thin-walled housings for the emulsions are described. The star production rate in emulsions flown in the mesosphere to a peak altitude of 217 km is $1180 \pm 280 \text{ cc}^{-1} \text{ d}^{-1}$ and is 1.45 ± 0.17 times greater than similar measurements in the stratosphere (30 km). The augmentation of nuclear disintegrations can be accounted for by the opening up of the effective solid angle for star-producing radiation during the rocket flight. Energetic stars with three or more shower particles record with a frequency of $278 \pm 30 \text{ cc}^{-1} \text{ d}^{-1}$, about three times greater than in a balloon flight at the same geomagnetic latitude. For large showers $N_s = 6$, the N/P ratio is about 0.17. The observational ratio of M to H nuclei based on a spectrum of 238 heavy primary tracks is 2.6_s . When corrected for fragmentation in surrounding matter this ratio is reduced to 2.5 ± 0.5 . The omnidirectional flux of heavy primaries $Z \geq 6$ at the top of the atmosphere is $7.62 \text{ meter}^{-2} \text{ sec}^{-1} \text{ sterad}^{-1}$. An analysis of the zenith angle distribution of the heavy primaries shows that the unidirectional flux is in fair agreement with geomagnetic theory for zenith angles $< 60^\circ$. The directional flux for $\theta > 60^\circ$ is about two times greater than predicted by theory. (auth)

2761

A STUDY OF NUCLEON INTERACTION WITH LIGHT NUCLEI AT THE ENERGY RANGE OF $10^9 + 10^{12} \text{ ev}$. S. N. Vernov, N. L. Grigorov, G. T. Zatsepin, and A. E.

Chudakov. (Lebedev Inst. of Physics). *Izvest. Akad. Nauk S.S.S.R. Ser. Fiz.* **19**, 493-501 (1955) Sept.-Oct. (In Russian)

Studies of various components of cosmic rays at different stratosphere levels revealed the basic characteristics of interaction processes of nucleons with light nuclei at various energies. Diagrams and tabulations are presented. 12 references. (R.V.J.)

2762

A CLOUD CHAMBER STUDY OF THE COSMIC-RAY HARD SHOWERS. Saburo Miyake and Kensaku Hinotani (Osaka City Univ., Japan) and Kan-ichi Nunogaka (Osaka Univ., Japan). *J. Phys. Soc. Japan* **11**, 76-83 (1956) Jan.

Cosmic ray hard showers produced in iron and in lead have been studied by using the multiplate cloud chamber at 2740 m above sea level. Primary energies of the meson producing showers were estimated from the angular and the momentum distributions of the secondaries by various methods, and the results were compared with each other. The observed hard showers were classified according to their median angles. About half of the showers which belong to the smaller median angle group may be interpreted as that they have been produced at the periphery of the Pb nuclei. They amount to about 20% of total hard showers. The mean free path for the production of hard showers was obtained as 250 ± 50 gr/cm² in lead, and the mean free path of the charge exchange scattering of pions was 1.0 ± 0.3 Kg/cm² in lead for energies greater than 1 Bev. (auth)

2763

THE FORMATION OF ³²P FROM ATMOSPHERIC ARGON BY COSMIC RAYS. L. Marquez and N. L. Costa (Centro Brasileiro de Pesquisas Fisicas, Rio de Janeiro, Brazil). *Nuovo cimento* (10) **2**, 1038-41 (1955) Nov.

It is shown by experiments that radioactive P³² is formed as a spallation product of argon by cosmic rays. This P³² is found in rain water, and its average activity in fresh rain water of Rio de Janeiro is 0.20 dpm/liter. (auth)

2764

THE LATITUDE EFFECT OF COSMIC RADIATION.

Martin A. Pomerantz (Bartol Research Foundation of the Franklin Inst., Swarthmore, Penna.). *Trans. Bose Research Inst. Calcutta* **20**, 41-54 (1955).

Experiments utilizing balloon-borne instruments have been undertaken to determine the importance of latitude effect on primary cosmic radiation. The latitude effect at low altitudes is determined, and the balloon-flight results are compared from this point of view with other related data. The latitude effect near sea level with respect to 18°N in India is $8.8 \pm 0.6\%$, and at an altitude corresponding to 567 mm. of Hg, at 23°N, is $13.1 \pm 0.6\%$. The latitude effect does not vary rapidly with interposed absorber thickness. Vertical G-M counter trains yield approximately the same latitude effect as ionization chambers throughout most of the atmosphere. (J.E.D.)

2765

ON THE OBSERVATION OF CERENKOV RADIATION ACCOMPANYING BROAD ATMOSPHERIC SHOWERS OF COSMIC RAYS. N. M. Nesterova and A. E. Chudakov (P. N. Lebedev Inst. of Physics). *Soviet Phys. JETP* **1**, 388-9 (1955) Sept. (In English). *Zhur. Eksptl. i Teoret. Fiz.* **28**, 384 (1955) Mar. (In Russian)

A parabolic mirror and a photomultiplier tube were used to demonstrate the possibility of observing the

Cherenkov radiation caused by wide cosmic-ray showers with energies of 10^{14} ev. (B.J.H.)

Refer also to abstract 2849.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

2766 AD-69092

Horizons, Inc., Cleveland.

MECHANISM OF CRYSTAL GROWTH FROM ELECTROLYSIS IN MOLTEN SALT SYSTEMS. Final Progress Report Anthony J. Kolk, Quentin H. McKenna, and Merle E. Sibert. July 20, 1955. 88p. Contract Nonr-1178 (00).

A detailed study of the process for the preparation of ductile titanium metal by electrolysis of a fused melt of NaCl and K₂TiF₆ has been completed. This research was directed primarily towards the elucidation of the cathode mechanism and the mechanism of crystal growth. In order to accomplish the aims above, the investigation followed three general approaches which were, namely: the study of the numerous process variables, crystallographic and physical evaluation of the metal produced, and a theoretical and experimental attack which involved specific conductance measurements and the voltammetric study of the electrode reactions in the system NaCl-K₂TiF₆. The cathode crystal growth process and its relation to the various electrolysis conditions have been investigated experimentally. The optimum conditions for the production of ductile, coarse crystalline titanium in a reproducible and predictable manner have been more accurately defined. The nature, size, and shape of the deposited Ti crystals have been correlated with the electrolysis variables by macroscopic and microscopic examination. (auth)

2767 OSR-TN-55-479

Yale Univ., New Haven.

THE PINNING OF DISLOCATIONS BY X-IRRADIATION OF ALKALI HALIDE CRYSTALS. R. B. Gordon and A. S. Nowick. Dec. 1955. 52p. Project R-355-40-14. Contract AF-18-(600)-850.

The effect of x irradiation on the room-temperature elastic modulus of NaCl crystals was studied. A modulus increase is observed on irradiation which is shown to correspond exactly to the elimination of the modulus decrease due to oscillating dislocation loops through the creation of pinning points along the dislocations. A quantitative theory is developed for the variation of modulus with x-ray dose. The effects of irradiation at low temperatures are also reported. (auth)

2768

PREDICTION OF MADELUNG CONSTANTS. David H. Templeton (Univ. of California, Berkeley and Univ. of Uppsala, Sweden). *J. Chem. Phys.* **23**, 1826-9 (1955) Oct.

Madelung constants of both simple and complex salts can be reduced to a common scale by taking the nearest-neighbor distance as the unit distance and then dividing by half the sum of the squares of the charges of all the atoms in the stoichiometric unit. These "reduced Madelung constants," α , can be predicted within a few percent by the relation $\alpha = 1.89 - 1/m$, where m is the harmonic mean coordination number. Madelung constants have been calculated for LaOCl, YOF, ReO₃, and several perovskite structures for comparison with the predictions. (auth)

2769

DIFFUSION OF ZINC IN SINGLE CRYSTALS OF SILVER. A. Sawatzky and F. E. Jaumot, Jr. (Franklin Inst. Labs. for Research and Development, Philadelphia). Phys. Rev. 100, 1627-9(1955) Dec. 15.

The diffusion of Zn in Ag has been measured in the temperature range from 640°C to 925°C, using high-specific-activity Zn^{65} as a tracer. The data indicate that the diffusion coefficient is given to within 2% by the equation, $D = 0.54 \exp(-41\,700/RT) \text{ cm}^2/\text{sec.}$ (auth)

ELECTRICAL DISCHARGE

2770 AEC-tr-2369

THE ATTAINMENT OF HIGH TEMPERATURES (UP TO 55,000°) UNDER LABORATORY CONDITIONS. O. Preining [Praining]. Translated from Uspekhi Fiz. Nauk 55, 595-608(1955). 12p. Available from Associated Technical Services (Trans. 84G7R), East Orange, N. J.

Included are some general remarks on the concept and measurement of high temperatures. A review is given on the methods of obtaining high temperatures of short duration, including nuclear reactions, explosions, explosion of wires by electric currents, and superpowerful spark. A more detailed review of the work done on the attainment of very high temperatures under stationary conditions by means of an arc discharge is given. (B.J.H.)

2771 AERE-Lib/Trans-533

MAGNETIC FIELDS IN TURBULENT PLASMAS. P. O. Schilling and W. Lochte-Holtgreven. Translated by R. J. Richardson from Z. Naturforsch. 9a, 520-6(1954). 12p.

If a plasma is subjected to non-conservative forces, which is possible with turbulent motion of the plasma, diffusion currents are produced which give rise to magnetic fields. It is shown that these magnetic fields may be detected experimentally when the flame gases of a burner operated on oxygen and propane are mechanically rotated. The experimental results are in good agreement with the theoretical explanation of these fields given by Biermann and Schlueter. (B.J.H.)

2772 AERE-Lib/Trans-621

THE THEORY OF THE DEVELOPMENT OF THE CHANNEL OF THE SPARK DISCHARGE. S. I. Drabkina. Translated by J. B. Sykes from Zhur. Eksptl. i Teoret. Fiz. 21, 473-83 (1951). 13p.

The theory of the development of the channel of the spark discharge is developed on the basis of hydrodynamical shock processes. The nature of the "envelope" of the channel is established, and its expansion in the discharge process is calculated. (auth)

2773

INVESTIGATION OF HIGH-FREQUENCY DISCHARGES BY THE PROBE METHOD. Kh. A. Dzherpetov and G. M. Pateiuk (Moscow State Univ.). Soviet Phys. JETP 1, 326-33(1955) Sept. (In English). Zhur. Eksptl. i Teoret. Fiz. 28, 343-51(1955) Mar. (In Russian)

A comparison is made of existing probe methods for the investigation of high-frequency discharges in He, Ne, A, and H_2 . Changes in a discharge which arise when additional electrodes—counterprobes—are inserted in a high frequency discharge are considered. An investigation is carried out of the distribution of temperature, electron concentration, and space potential along the axis of the

discharge tube, and also of the dependence of these parameters upon the gas pressure and the voltage of the high-frequency field at the exterior electrodes of the discharge tube. (auth)

2774

THE CONSTRICTION AND CURVATURE OF AN ARC IN RAREFIED GASES AT LARGE CURRENTS. V. L. Granovskii and G. G. Timofeeva (All-Union Electro-technical Inst.). Soviet Phys. JETP 1, 381-2(1955) Sept. (In English). Zhur. Eksptl. i Teoret. Fiz. 28, 378(1955) Mar. (In Russian)

Experiments were performed on the constriction and curvature of an arc in rarefied gases for large currents. Results of the experiments are shown for A and Hg and indicate that the observed phenomena are caused by the electrodynamic effects of the magnetic field of the arc. (B.J.H.)

2775

ON THE MAGNETO-HYDRODYNAMICS OF COMPRESSIBLE MEDIA. R. W. Larenz (Hanover Technical Inst., Germany). Z. Naturforsch. 10a, 761-5(1955) Sept.-Oct. (In German)

In a consistent theory of compressible plasmas, the charge breakdown must be considered, especially when macroscopic velocities occur which are equal to or greater than the speed of sound. The installation of the charge breakdown for a two component plasma is summarized, and the system of magneto-hydrodynamical equation thus converted so that it yields only 2 quantities: the vector potential and plasma velocity. (tr-auth)

2776

LARGE AMPLITUDE PLASMA CURRENTS AND BREAKDOWN. R. W. Larenz (Hanover Technical Inst., Germany). Z. Naturforsch. 10a, 766-76(1955) Sept.-Oct. (In German)

As a foundation for fitting charge breakdown in the magneto-hydrodynamics of compressible media, a one dimensional sound-wave-like plasma motion is studied. Specifically, currents, characterized as "ion sounds" and "electron sounds," of large amplitudes and periodic and non-periodic structure result. These can lead to practically complete regional charge breakdowns under suitable conditions. For the limit of the charge breakdown, which is determined by a function of the temperature, the pressure increases remarkably. (tr-auth)

Refer also to abstracts 2846 and 2961.

ELECTRONS

2777

COMPENSATION THEORY OF VOLUME CHARGE OF ION BEAMS IN STABLE STATES. V. S. Anastasevich. Doklady Akad. Nauk S.S.S.R. 105, 442-4(1955) Nov. 21. (In Russian)

Usually in studies of the compensation theory it is considered that the slow, positive ions which form with electrons during ionization, pass into the walls and are of no importance. Calculations are made to show that the part played by the secondary ions in the compensation and decompensation processes of the beam is as important as that of the electrons. (R.V.J.)

2778

ON THE ENERGY DETERMINATION OF ELECTRON PAIRS. E. Lohrmann (Univ. of Bern, Switzerland). Nuovo cimento (10) 2, 1029-37(1955) Nov.

The limitations of determining the energy of electron pairs by means of their angular divergence are investigated by considering in detail the influence of multiple scattering. It is shown that at energies of the order of 1 Bev and higher the divergence of electron pairs is essentially determined by multiple scattering. (auth)

2779

DOUBLE SCATTERING OF ELECTRONS WITH MAGNETIC INTERACTION. II. DEPOLARIZATION. H. Mendlowitz and K. M. Case (Univ. of Michigan, Ann Arbor). Phys. Rev. **100**, 1551-7(1955) Dec. 15.

The depolarization occurring in attempts to measure the electron's gyromagnetic ratio by double-scattering experiments in a magnetic field is discussed. Formulas are found for the effects expected to be most significant. These are applied to estimate the possible accuracy obtainable. One part in 10^5 seems to be quite feasible. In addition, formulas are appended which permit rapid estimation of other depolarization effects. (auth)

2780

BREMSSTRAHLUNG DIFFERENTIAL CROSS-SECTION MEASUREMENTS FOR 0.5- AND 1.0-MEV ELECTRONS. J. W. Motz (National Bureau of Standards, Washington, D. C.). Phys. Rev. **100**, 1560-71(1955) Dec. 15.

The bremsstrahlung cross section, differential in photon energy and angle, has been determined by measuring the x rays emitted from thin targets of beryllium, aluminum, and gold, for incident electron energies of 0.5 and 1.0 Mev, with a 5-inch diameter, 4-inch long NaI(Tl) scintillation spectrometer at angles of 0, 10, 20, 30, 60, 90, and 120 degrees. The results show that in this energy region, the Bethe-Heitler-Sauter (Born approximation) theory underestimates the cross section. A comparison of the cross section for beryllium and aluminum gives evidence for electron-electron bremsstrahlung. The experimental values for the Heitler parameter $\phi_{\text{rad}} / \bar{\phi}$ with a gold target are 10 at 1.0 Mev and 9.5 at 0.5 Mev. The low-Z values for $\phi_{\text{rad}} / \bar{\phi}(1 + 1/Z)$ are 8.8 for beryllium and 8.4 for aluminum at 1.0 Mev and 6.8 for aluminum at 0.5 Mev. The accuracy of these values is estimated to be better than 20%. The corresponding Bethe-Heitler values for $\phi_{\text{rad}} / \bar{\phi}$ are 6.5 at 1.0 Mev and 5.5 at 0.5 Mev. (auth)

2781

ON THE ANGULAR DISTRIBUTION OF β -RADIATION. II. G. R. Khutsishvili. Soviet Phys. JETP **1**, 376(1955) Sept. (In English). Zhur. Ekspit. i Teoret. Fiz. **28**, 370-1(1955) Mar. (In Russian)

An expression is given for the distribution of β radiation as a function of energy and angle for $\Delta I = \pm 2$. (B.J.H.)

Refer also to abstracts 2915 and 2963.

GASES

2782 AD-62517

Illinois Inst. of Tech., Chicago.

ACCOMMODATION COEFFICIENTS AND THERMAL CONDUCTIVITIES OF HYDROGEN, HELIUM, AIR AND ARGON FOR CHROME SURFACES AT REDUCED PRESSURES. Technical Report No. 1. Ralph E. Peck and Joseph D. Lokay. May 20, 1955. 89p. Project TB2-0001 (794). Contract DA-11-022-ORD-1249.

The determination of the thermal conductivities of hydrogen, helium, air, and argon at reduced pressures

and the measurement of the accommodation film coefficients of a chrome surface for the same four gases at reduced pressures were studied. The pressure range studied was 1 to 1000 μ of mercury. The average temperature was 111°F. with the maximum temperature variance being $\pm 5^\circ\text{F}$. The data were found to be reproducible. The experimental equipment was checked by making several experimental determinations at atmospheric pressure, and the values of the thermal conductivities determined were within 1% of the best literature values. A unique method of determining the accommodation film coefficient from the variance in thermal conductivity at constant temperature and pressure is presented. Values of the accommodation film coefficient are presented. The numerical values of the accommodation film coefficients were found to be large enough in magnitude that its effect could be neglected for pressures higher than 1000 μ . The thermal conductivities were found to be constant for the pressures from 200 μ to atmospheric pressure at constant temperature. (auth)

2783 RM-1543(RAND)

RAND Corp., Santa Monica, Calif.

EQUILIBRIUM COMPOSITION AND THERMODYNAMIC PROPERTIES OF AIR TO 24,000°K. F. R. Gilmore.

Aug. 24, 1955. 70p.

Data are reported on the composition, pressure, energy, and entropy of dry air at eleven temperatures between 1000 and 24,000°K, and eight densities between 10^{-6} and 10 times normal density, using a revised value for the dissociation energy of N_2 . The ideal-gas internal energies and free energies of 29 molecules, atoms, and ions are also reported. Hugoniot curves for air at various initial densities are included. (C.W.H.)

2784 RM-1554

RAND Corp., Santa Monica, Calif.

ABSORPTION COEFFICIENTS OF AIR FROM 6000°K TO 18,000°K. Roland E. Meyerott. Sept. 9, 1955. 12p.

The absorption coefficients of air in the temperature range from 6000 to 18,000°K were determined. Data are tabulated. Contributions to the absorption of air in this temperature range include continuous contributions arising from absorption by O^- and NO_2 , and discrete contributions which come from the line absorption in the band spectra of the N_2 , NO, and N_2^+ molecules. The largest uncertainties in the present table result from a lack of information about the f-numbers for the discrete transitions in the molecules, and lack of information about the width of the spectra lines. In the calculations presented, an f-number of 0.2 was used for the discrete transition and the lines were assumed to be smeared uniformly in each band. (C.H.)

2785

GAS ABSORPTION ACCOMPANIED BY CHEMICAL REACTION. P. V. Danckwerts (United Kingdom Atomic Energy Authority, Warrington, Lancs, England). A.I.Ch.E. Journal **1**, 456-63(1955) Dec.

Processes occurring on the liquid side of the interface when gases are absorbed by liquids, and by reactive liquids, in particular, are discussed. The film and penetration models of gas absorption are applied to problems of industrial design. (C.W.H.)

2786

EFFECT OF α PARTICLES ON GASEOUS H AND D. Solange Lormeau-Loustau. Compt. rend. **241**, 1758-60 (1955) Dec. 14. (In French)

The intensity of emitted ultraviolet rays does not verify the usual laws, and at equal pressures, deuterium gives forth an emission 1.7 times stronger than that of hydrogen. (tr-auth)

Refer also to abstracts 2773, 2777, and 2924.

INSTRUMENTS

2787 NBS-C-567

National Bureau of Standards, Washington, D. C. GUIDE TO INSTRUMENTATION LITERATURE. W. G. Brombacher, Julian F. Smith, and Lyman M. Van der Pyl. Dec. 14, 1955. 160p. Charge \$1.00(GPO).

This compilation consists of an introduction, a source list of instrumentation literature, an author index, and a subject index. Over 1200 references are listed, including abstract journals, bibliographies, 660 books on technology, directories of manufacturers, guides to and indexes of technical literature, periodicals of interest, and guides to dissertations, patents and specifications. Articles published in periodicals are not referenced, but indexes and abstracts of such articles on a given subject are indicated in the subject index. (auth)

2788 NOL-CORONA-151

Naval Ordnance Lab., Corona, Calif. COMPUTING MACHINE COMPONENTS PROGRAM. Quarterly [Progress] Report [No. 7] for January-March 1954. Feb. 1955. 59p.

Evaporated Ni-Fe films with very rectangular hysteresis loops were produced by placing the film substrate in a magnetic field during operation. Modifications of the test apparatus for evaporated magnetic cores are shown. Circuit diagrams are given for a high-frequency magnetic core tester. The high-frequency switching properties of ferrite cores were investigated. A shift register design is discussed. An analysis is made of 10-Mc basic computer circuits. A circuit for propagating carry pulses is discussed and analyzed. A general discussion is given on beam deflection devices. Results of studies of the time required for the reversal of the direction of magnetization of a film of ferromagnetic material are included. (For preceding period see NOL-CORONA-143.) (B.J.H.)

2789 NP-5867

Mine Safety Appliances Co., Callery, Penna. HIGH TEMPERATURE PRESSURE GAGE. Technical Report No. 45. E. C. King and V. K. Heckel. Jan. 5, 1956. 24p. Contract NObs-65426.

A pressure gage has been developed for high temperature liquid metal service that will either record or indicate remotely from a radioactive area. The accuracy achieved in some cases is better than $\pm 1\%$, and is consistently better than $\pm 2.5\%$ of full scale. (auth)

2790 WADC-TR-54-352

Wright Air Development Center, Aeronautical Research Lab., Wright-Patterson AFB., Ohio. ELECTRIC FLOWMETER (THOMAS PRINCIPLE). F. G. Penzig. July 1954. 94p. Project title: FIGHTER FIRE CONTROL TECHNIQUE AND COMPONENTS.

It is shown that the principle of electric flowmeters can be successfully used for flow measurement of a liquid such as aircraft fuel. The temperature difference produced in the flowmeter can be sensed either by resistance thermometers or by thermocouples, each method having

particular advantages. The theory of both instruments as well as methods for compensation of various influences are discussed. Several experimental flowmeters were built and used in tests. In contrast to existing types of flowmeters the transducer of this type contains no moving parts and requires no precision work in production. Another advantage is the immediate electric signal which can be utilized for indication, computing or telemetering. (auth)

2791

HIGH SENSITIVITY AND ACCURACY PULSE TRIGGER CIRCUIT. S. Barabaschi, C. Cottini, and E. Gatti (Laboratori CISE, Milan, Italy). Nuovo cimento (10) 2, 1042-51 (1955) Nov.

A high sensitivity pulse height selector is described which uses a retarding field diode and a differential negative resistance of high stability obtained by means of a multi-electrode electronic tube using the current division between screen grid and anode. The threshold of the discriminator can be set in the range of 1 to 30 mv its stability being, in this range, better than 1%. (auth)

2792

A MERCURY SAFETY VALVE FOR ELECTROLYSIS OF HEAVY WATER. R. M. Chaudhri (Government Coll., Lahore, Pakistan). Proc. Phys. Soc. (London) B68, 1157-8 (1955) Dec. 1.

Designs are given for a mercury safety valve which maintains a constant pressure in the heavy water electrolyzing cell, thus minimizing the danger that the electrolyte might split due to sudden changes of pressure over the electrolyte in the two sides of the cell. (B.J.H.)

2793

DESIGN FOR THE CONSTRUCTION OF A POSITIVE ION SOURCE. W. Dillenbach. Z. Naturforsch. 10a, 803-5 (1955) Sept.-Oct. (In German)

ISOTOPES

2794

PREPARATION OF CARRIER-FREE YTTRIUM-90. Toshiyasu Kiba, Shigeru Ohashi, and Tada-aki Minabe (Kanazawa Univ., Japan). Bull. Chem. Soc. Japan 28, 443-4 (1955) Aug.

2795

DISCREPANCY BETWEEN THE SPECTRO-ISOTOPIC AND THE MASS-SPECTROMETRIC RESULTS FOR THE NATURAL ABUNDANCE RATIO OF THE LITHIUM ISOTOPES. A. H. Gillieson and R. P. Thorne (Atomic Energy Research Establishment, Harwell, Berks, England). Nature 176, 1228-9 (1955) Dec. 24.

Determination of the natural abundance ratio of the lithium isotopes Li^6/Li^7 by spectroscopic and mass-spectrometric techniques gave values of 12.5 ± 0.3 and 12.2 ± 0.1 respectively. The discrepancy between the experimental methods was reduced by application of a correction factor for peak line intensities in the spectroscopic method. (C.W.H.)

2796

SCINTILLATION COUNTING OF (n, α) AND NEUTRON FISSION REACTIONS AS AN ISOTOPIC ANALYSIS OF LITHIUM, BORON, AND URANIUM. H. Wänke and E. U. Monse (Max Planck Inst. for Chemistry, Mainz, Germany). Z. Naturforsch. 10a, 667-9 (1955) Sept.-Oct. (In German)

A method is described for the relative determination of the isotopic abundance of Li, B, and U, based on the $\text{Li}^6(n,\alpha)\text{H}^3$, $\text{B}^{10}(n,\alpha)\text{Li}^7$, and $\text{U}^{235}(n,f)$ reactions. The tritons, α particles, and fission products occurring in these reactions are detected by scintillation counters. A Ra-Be preparation is used as a neutron source. The natural isotopic composition of lithium in the form of an "infinite" thick layer of LiF given 300 counts/min under optimum conditions. The natural isotopic composition of amorphous boron gives a total effect of 135 counts/min under the same conditions but with a different discriminator setting. An "infinite" thick layer of naturally occurring U_3O_8 gave 6 counts/min. (tr-auth)

ISOTOPE SEPARATION

2797 AECD-3726

Westinghouse Electric Corp. Research Labs., East Pittsburgh, Penna.

AN ATTEMPTED SEPARATION OF MERCURY ISOTOPES. Walter Kauzmann. Apr. 30, 1942. Changed from OFFICIAL USE ONLY Dec. 21, 1955. 5p. (SR-119)

Equilibrium of heavy atoms between two states was investigated as a possible means for the separation of isotopes. It was planned to apply the method in the separation of U isotopes. Preliminary studies were conducted on the partition of Hg between aqueous solution and metallic Hg. After a careful check of results, it was concluded there is no basis, either theoretical or experimental, for expecting any considerable separation by processes of the type employed. The validity of the application of quantum statistics in studies of this type is discussed. (C.H.)

2798

SEPARATION OF RaD, RaE AND RaF BY ION EXCHANGE. Tatsujiro Ishimori (St. Paul's Univ., Tokyo). *Bull. Chem. Soc. Japan* 28, 432-5 (1955) Aug.

RaD, RaE and RaF may be satisfactorily separated from each other by means of an anion exchanger, Amberlite XE-98. Carriers are not necessary. The use of an anion exchanger and strong acidities of eluents helps to prevent the formation of radiocolloids. The separation technique seems to be highly suitable for the preparation of carrier-free RaE and RaF tracer. It is efficient in separation and easy to manipulate. (auth)

2799

SEPARATION OF SOME ISOTOPES BY CONVECTION DIFFUSION. D. Heymann and J. Kistemaker (Laboratorium voor Massaspectrografie, Amsterdam, Netherlands). *J. Chem. Phys.* 24, 165-6 (1956) Jan.

The separation of Ne, A, H_2 , O_2 and N_2 isotopes by convection diffusion has been investigated. A brief description of the columns used is included. (C.W.H.)

2800

PREPARATION OF THE RARE ISOTOPE Ne^{21} . P. A. K. Clusius, M. Huber, H. Hürzeler, and E. Schumacher (Univ. of Zurich, Switzerland). *J. Chem. Phys.* 24, 167-8 (1956) Jan.

Neon isotope Ne^{21} has been separated and concentrated from natural neon ($\sim 0.25\% \text{Ne}^{21}$) by means of thermal diffusion columns followed by stripping with deuterated amines. Fractions containing $\sim 99.6\% \text{Ne}^{21}$ have been isolated. (C.W.H.)

2801

THE AMMONIA-AMMONIUM CARBONATE SYSTEM FOR THE CONCENTRATION OF NITROGEN-15. G. M. Begun, A. A. Palko, and L. L. Brown (Oak Ridge National Lab., Tenn.). *J. Phys. Chem.* 60, 48-51 (1956) Jan.

The isotopic exchange reaction between gaseous NH_3 and $(\text{NH}_4)_2\text{CO}_3$ solution saturated with dissolved NH_3 has been studied. Rapid exchange was found between carbamate ion and the other nitrogen species present. The effective separation factor at atmospheric pressure determined from single stage equilibrations was found to be 1.015 at 15.6° , 1.019 at 25.8° , 1.021 at 35.9° , and 1.022 at 44.3°C . Calculations from the data gave the following values for the separation factor between gaseous NH_3 and carbamate ion: 1.023 at 15.6° , 1.021 at 25.8° , 1.021 at 35.9° , and 1.019 at 44.3° . In both cases, N^{15} concentrates in the aqueous phase. Column studies were in agreement with this datum and showed the system to be a feasible one for the production of enriched N^{15} . (auth)

Refer also to abstract 2667.

MASS SPECTROGRAPHY

2802 AERE-Lib/Trans-629

THE USE OF AN INHOMOGENEOUS MAGNETIC FIELD TO INCREASE THE RESOLUTION OF THE MASS-SPECTROMETER. N. E. Alekseevskii, G. P. Prudkovskii, G. I. Kosourov, and S. I. Filimonov. Translated by V. Beak from *Doklady Akad. Nauk S.S.S.R.* 100, 229-32 (1955). 6p.

Title Listed in *Nuclear Science Abstracts* as NSA 9-2843.

2803

IMPROVEMENTS AND PRESENT EFFICIENCY OF DOUBLE FOCUSING MASS SPECTROGRAPHS. R. Bieri, F. Everling, and J. Mattauch (Max Planck Inst. for Chemistry, Mainz, Germany). *Z. Naturforsch.* 10a, 659-67 (1955) Sept.-Oct. (In German)

A series of improvements which were made on the mass spectrometer are described. They refer, along with the attainment of quicker and more dependable work with the apparatus, to the exact matching of the theoretical requirements, to the increase of the stability of the potential adjustment of the beam path, to the vacuum, and the stabilization of the field intensity. As a test for the efficiency of the resolving power, surveys show the value of M/dM to be 100,000. (tr-auth)

MATHEMATICS

2804 KAPL-1415

Knolls Atomic Power Lab., Schenectady, N. Y. ONE-SPACE-DIMENSIONAL MULTIGROUP FOR THE IBM 650. PART I. EQUATIONS. G. J. Habetler. Dec. 1, 1955. 43p. Contract W-31-109-Eng-52. \$0.30 (OTS).

The one-space dimension multigroup formulas planned and programmed for the IBM 650 at KAPL are presented. The group constants for the usual KAPL integration schemes are derived in some detail. Group constants for and experimental scheme involving a change of dependent variable in the age-diffusion equation are derived. (auth)

2805 NYO-6482

New York Univ., New York. Atomic Energy Commission Computing Facility.

A REPORT ON A MODIFIED ROUTH METHOD FOR LOCATING ROOTS OF POLYNOMIALS. Eugene Isaacson, Michael Held, and Thomas Seidman. Dec. 1, 1955. 22p. Contract AT-(30-1)-1480.

A method for obtaining the complex roots of polynomials of degree less than or equal to twenty with real coefficients is described. Both the mathematical and Univac aspects are discussed. (auth)

2806 ORNL-1983

Oak Ridge National Lab., Tenn.

THE GENERATION OF ERROR IN DIGITAL COMPUTATION. Alston S. Householder. Oct. 31, 1955. 80p. Contract W-7405-eng-26. \$12.30(ph OTS); \$4.50 (mf OTS).

2807

ON THE RECIPROCITY PROBLEM OF SPECTRAL ANALYSIS FOR SCHROEDINGER'S EQUATION. Yu. M. Berezhanskiĭ (Inst. of Math.) Doklady Akad. Nauk S.S.S.R. 105, 197-200(1955) Nov. 11. (In Russian)

2808

ON DETERMINING THE BOUNDARY LAYER POSITION IN THE TWO PHASE HEAT CONDUCTING MEDIA IN ITS STABLE THERMAL STATE. L. I. Rubinshtein. (Krasnodarskiĭ State Oil-Gas Research Inst.) Doklady Akad. Nauk S.S.S.R. 105, 437-8(1955) Nov. 21. (In Russian)

This investigation interprets the temperature and the boundary layer in two-phase heat conducting media in stable thermal state in relation to the studies on con- gelation. (R.V.J.)

2809

ON DETERMINING THE LIMITS OF QUANTUM MECHANICAL APPLICATIONS BY MEASURING THE ELECTRON MOMENT. G. M. Gandel'man and Ya. B. Zel'dovich (Inst. of Chemical Physics). Doklady Akad. Nauk S.S.S.R. 105, 445-7(1955) Nov. 21. (In Russian)

MEASURING INSTRUMENTS AND TECHNIQUES

2810 HW-32516

[Hanford Atomic Products Operation, Richland, Wash.]. GAMMA DOSE MEASUREMENT WITH HANFORD FILM BADGES. H. V. Larson and W. C. Roesch. July 21, 1954. 13p. Contract [W-31-109-Eng-52].

Procedures are described for γ dose measurements which utilize film badges exposed to photons all having nearly the same energy. Densities above fog are measured on the Ag-shielded and on the unshielded portions of the film. For photon energies below 200 kv the energy can also be determined from these data. (C.H.)

2811 HW-32534

[Hanford Atomic Products Operation, Richland, Wash.]. SURFACE DOSE RATE FROM THORIUM. William C. Roesch. July 23, 1954. 5p. Contract [W-31-109-Eng-52].

Calculations are presented for the determination of surface dose rates from Th. The Th decay chain is examined and changes in radioactive equilibrium following the preparation of Th metal are calculated. The relevant emitters and the dose rates each would contribute at equilibrium to surface dose are tabulated. Measurements were made with an extrapolation chamber. The results

were 56 mrad/hr through no absorber and 53 mrad/hr through 7 mg/cm² of tissue equivalent material. Measurements with tissue equivalent absorbers in the extrapolation chamber indicated on initial absorption coefficient of about 7.5 cm²/gm. Measurements with a mica window counter indicate that absorption is the same for Al, polyethylene, and leather glove material. (C.H.)

2812 HW-32696

[Hanford Atomic Products Operation, Richland, Wash.] GAMMA RAY CALIBRATION OF GOLD SHIELD BADGES. H. V. Larson. Aug. 6, 1954. 4p. Contract [W-31-109-Eng-52].

Film badges with extra windows covered with one-mil Au foil were prepared to differentiate between β and soft γ radiations in the calibration of Dupont 552 film packets. Calibration procedures for the Au shield badges are described. (C.H.)

2813 HW-32720

Hanford Atomic Products Operation, Richland, Wash. AN IMPROVED BETA DOSE READING CHAMBER. E. E. Donaldson. Aug. 26, 1954. 24p. Contract [W-31-109-Eng-52].

The problems involved in measuring β skin doses are discussed. The development and design of a cylindrical ionization chamber for measuring dose rates are described and the response is compared with that of several other standard chambers. (C.H.)

2814 NCSC-109

North Carolina State Coll., Raleigh. SCINTILLATION COUNTER GAMMA RAY MEASUREMENTS. Arthur Waltner. Sept. 1955. 12p. Contract DA-36-034-ORD-1656.

Two general types of γ ray measurements were made involving the use of Tl-activated NaI in conjunction with a RCA 5819 photomultiplier as the radiation detector. In the first measurements, time exposures were made of an oscilloscope screen and γ ray energies deduced from the photoelectric lines observed on the photograph. Densitometer measurements were made of some of the negatives in order to make more accurate measurements of the position and relative intensity of the lines. In the second set of measurements no photographs were taken but integral counting rates were taken with the discriminator set at levels corresponding to various energies. Measurements were made over the boron curtain of the Raleigh Reactor to investigate the contribution of $B^{10}(n,\alpha)Li^7\gamma$ rays resulting from the excited Li^7 produced; the Al^{28} decay γ ray (2.20 Mev); the capture γ of the $C^{12}(n,\gamma)C^{13}$ reaction; the In^{116} decay scheme; Al capture and decay γ ; H capture γ rays in lucite; the effect of 6-in. Pb plug in the thermal column with graphite in the channel; and the effect of 6 in. Pb plug with all graphite out of the channel. Results are tabulated and compared. It was concluded that the photographic method of pulse height analysis gives satisfactory results. The integral counting experiments indicate that the capture and decay γ of Al constitute a considerable fraction of the high-energy γ rays at the thermal column of the Raleigh reactor. (C.H.)

2815 NRL-4680

Naval Research Lab., Washington, D. C. A PORTABLE READER FOR DT-60 DOSIMETERS. J. C. Schaffert. Nov. 30, 1955. 11p. Projects NR-623-010 and NE 051-551.

A portable, self-powered computer-indicator (reader) for DT-60/PD phosphate glass dosimeters has been designed, constructed, and demonstrated. The reader indicates on a meter the total γ dose accumulated by a DT-60 dosimeter. Operation by means of self-contained batteries is provided. The reader is also operable from an external source of either six v dc or 115 v ac. Total weight of the reader is twenty lb, nine lb of which is in the battery supply. The housing of the reader measures 7.5 by 8 by 11 in. over-all. This reader, designed and constructed to demonstrate the feasibility of self-powered operation, will form the basis for continued development. In particular, there may be some advantages to a reader designed to use a pulse-type of ultraviolet source. Such a design is now being attempted. (auth)

2816 ORNL-2013
Oak Ridge National Lab., Tenn.
NEUTRON SCATTERING. John Wilder Cure, III.
Jan. 30, 1956. 39p. Contract W-7405-eng-26. \$6.30(ph OTS); \$3.00(mf OTS).

Scattered radiation reaching the point of measurement is one of the major problems of neutron dosimetry. An experiment was designed to determine the variation in neutron dose rate at a point in air as a function of distance between the source and the detector, and as a function of the height of the source and detector above a concrete slab. The experimental data are compared with data obtained from the albedo theory, and the results agree within the experimental error. When a conical frustum of paraffin, which reduces the direct beam of neutrons by a factor of a few thousand, was placed between the source and detector, only the scattered neutrons contributed to the dose rate. This method gives data which enables one to correct for scattered radiation. To reduce extraneous scattering material to a minimum the detector and source were supported five feet below a steel bar which was suspended from two painter's scaffolds forty feet apart and fifty-five feet high. The neutron source was Po-B, which gave neutrons with an average energy of 2.5 Mev. The dosimeter was a proportional counter, ethylene-polyethylene type, with a pulse integrator for measuring the tissue dose. It was found that the inverse square law predicts the dose rate for distances up to approximately 1.5 m between the source and the detector; and if the source, and detector are 1.5 m from the walls and floor the dose rate contribution at the detector due to scattered neutrons is less than 6%. The results of this experiment apply directly to the calibration of a neutron dosimeter in air. (auth)

2817 USNRDL-TR-65
Naval Radiological Defense Lab., San Francisco.
A FAST COMPTON SCINTILLATION SPECTROMETER.
P. R. Howland, N. E. Scofield, and R. A. Taylor. Oct. 6, 1955. 69p. Project NS 081-001.

A Compton gamma-ray spectrometer has been developed for the purpose of analyzing gamma-ray spectra resulting when extended slabs of shielding matter are placed in specified fields of gamma radiation. The spectrometer employs a fast 6BN6 coincidence circuit, operated by the amplified coincidence pulses from a pair of Dumont 6292 photomultipliers. A series of wide-band chain amplifiers amplifies the photomultiplier pulses before mixing in the coincidence circuit. A multi-channel pulse height analyzer records the pulse height spectra. The useful energy range is from 200 kilovolts to somewhat above 1 Mev. (auth)

2818 AERE-Lib/Trans-587
A HIGH-THRESHOLD SCINTILLATION DETECTOR OF NEUTRONS. P. S. Baranov and V. I. Gol'danskii. Translated by J. B. Sykes from Zhur. Eksptl. i Theoret. Fiz. 28, 621-3(1955). 5p.

A high-energy neutron detector is described which uses a scintillation detector to record the recoil protons from the reaction $C^{12}(n,2n)C^{11}$. The cross section for this reaction remains practically constant in the neutron energy range from 90 Mev to 380 Mev. Data are presented on the excitation function for the reaction, the mechanism of the reaction, and the optimum duration of observation of C^{11} decay. A block diagram of the apparatus is included. (C.H.)

2819 AERE-Lib/Trans-588
PROSPECTS FOR THE USE OF IMPULSE MULTIGRID ELECTRON-OPTIC TUBES TO RECORD TRACKS ON IONISING PARTICLES IN LUMINESCENT MEDIA. G. A. Askar'yan. Translated by J. B. Sykes from Zhur. Eksptl. i Theoret. Fiz. 28, 626-7(1955).

2820
DESIGNS OF A SPECTROMETER FOR γ - γ AND HEAVY PARTICLE- γ COINCIDENCES. APPLICATION TO THE $B^{10}(d,p)B^{11}$ REACTION. Serge Gorodetzky, Andre Gallmann, Michel Croissiaux, and Raymond Armbruster. Compt. rend. 241, 1743-6(1955) Dec. 14. (In French)

Designs for the coincidence scintillation spectrometer are given. The spectrometer was used for the study of p- γ coincidences from B^{11} , and the p- γ angular correlation corresponding to the 2.14-Mev level of B^{11} was measured. (B.J.H.)

2821
NEW TYPE OF BETA-, GAMMA-RAY DETECTOR. E. W. Godbole (Institute of Science, Bombay, India). J. Chem. Phys. 24, 166(1956) Jan.

A radiation detector, employing alternating frequency instead of d-c, is described. It consisted of a soda glass tube evacuated and filled with iodine vapor. Alternating potentials of frequency 50 cycles/sec were applied between two ring electrodes wound on the tube. One of the electrodes was connected to the high voltage and the other was grounded through a high resistance. The resultant potential drop was examined visually and aurally. The detector was found to be appreciably photosensitive. (C.W.H.)

2822
ON A β SCINTILLATION SPECTROMETER WITH IMPROVED RESOLVING POWER. Serge Gorodetzky, Raymond Armbruster, Pierre Chevallier, and André Gallmann (Institut de Recherches Nucléaires, Strasbourg, France). J. phys. radium 16, 939-40(1955) Dec. (In French)

2823
COUNTING TRITIATED WATER AT HIGH HUMIDITIES IN THE GEIGER REGION. Edward B. Butler (Libbey-Owens-Ford Glass Co., Toledo, Ohio). Nature 176, 1262-4(1955) Dec. 31.

2824
MEASUREMENT OF TRITIUM IN WATER SAMPLES. J. F. Cameron (Atomic Energy Research Establishment, Harwell, Berks, England). Nature 176, 1264(1955) Dec. 31.

2825
THE LOS ALAMOS HUMAN COUNTER. Ernest C. Anderson, Robert L. Schuch, James D. Perrings, and Wright H. Langham (Los Alamos Scientific Lab., N. Mex.). Nucleonics 14, No. 1, 26-9(1956) Jan.

The Human Counter was designed to detect γ activity in human beings at levels well below the recommended maximum permissible concentrations. The sensitivity of the detector is 5×10^{-10} c for a nuclide emitting 1 γ ray per disintegration, and its sample capacity is 300 lbs. With the Human Counter, the natural K^{40} content of the human body ($\sim 10^{-8}$ γ -ray curies) can be measured to a precision of 5% in 2 min of counting time. The counter consists of 140 gal of liquid scintillator contained in a cylindrical annulus. Scintillations are detected by 108 photomultiplier tubes. Design and performance of the counter are described, and the major research programs planned for it are summarized. Results of a study of the variation of potassium content in people as a function of weight and age are presented. (M.P.G.)

2826

GLASS DOSIMETRY. S. Davison, S. A. Goldblith, and B. E. Proctor (Massachusetts Inst. of Tech., Cambridge). Nucleonics 14, No. 1, 34-9(1956) Jan.

The use of silver-activated phosphate glass as a high-level dosimeter has several advantages including chemical inertness, rigidity, insolubility, small size, and permanence. The properties of silver-phosphate glass have been studied, and data are presented on the effects of storage temperature and heat treatment. The feasibility of using silver-phosphate glass in high-energy electron-beam dosimetry has been demonstrated. (M.P.G.)

2827

LIQUID SCINTILLATORS. II. PULSE-HEIGHT COMPARISON OF SECONDARY SOLUTES. F. Newton Hayes, Donald G. Ott, and Vernon N. Kerr (Los Alamos Scientific Lab., N. Mex.). Nucleonics 14, No. 1, 42-5(1956) Jan.

The secondary solute in a double-solute liquid scintillation system receives excitation energy from the primary solute and emits it as photons with a characteristic spectrum. The testing methods used in a study of secondary solutes are described, and pulse height data are presented for 24 compounds. The performance of 5 solutions in large detectors is discussed. It is concluded that a double-solute liquid scintillator is capable of yielding a better combination of wavelength and pulse height than a single-solute system. (M.P.G.)

2828

DETERMINING CONCENTRATION OF AIRBORNE PLUTONIUM DUST. G. W. C. Tait (Atomic Energy of Canada Ltd., Chalk River, Ont.). Nucleonics 14, No. 1, 53-5(1956) Jan.

An annular impactor has been designed to separate airborne particles into 2 groups, greater and less than 1-micron diameter, and to sample the α activity of the larger particles. With this device it is possible to detect airborne Pu dust, which is generally in large particles, in the presence of Rn-decay products, which are preferentially associated with the smaller particles. Design, operation, and testing of the impactor are described. It was found to have a sampling efficiency of $\sim 90\%$ for dusts generated by normal technical processes and an efficiency of $\sim 10\%$ for Rn-decay products. (M.P.G.)

2829

A SYSTEM OF MEGAROENTGEN GLASS DOSIMETRY. Norbert J. Kreidl and Gerald E. Blair (Bausch and Lomb Optical Co., Rochester, N. Y.). Nucleonics 14, No. 1, 56-60(1956) Jan.

An investigation of radiation-sensitive glass is described. Data are presented on absorption change with dose, fading, energy dependence, and reproducibility for glass containing Ag or Co. It is concluded that a dosimeter system consisting of a simple spectrophotometer and radiation-sensitive glass is suitable for the measurement of routine doses of high-energy radiation in the dose range of 5×10^3 to 4×10^6 rep. It could be used for other dose rates and radiation energies by recalibration. The system has the advantages of ruggedness, low cost, and good reproducibility. (M.P.G.)

2830

FISSION CHAMBER MEASURES NEUTRON DISTRIBUTION QUICKLY, ACCURATELY. Robert G. Nobles and Alan B. Smith (Argonne National Lab., Lemont, Ill.). Nucleonics 14, No. 1, 60-2(1956) Jan.

An ionization chamber is described which measures neutron flux quickly and accurately. The chamber contains an electrode coated with fissionable material. Performance of the chamber is reported. (M.P.G.)

2831

PREPARATION OF C^{14} STANDARD FOR LIQUID SCINTILLATION COUNTER. D. L. Williams, F. N. Hayes, R. J. Kandel, and W. H. Rogers (Los Alamos Scientific Lab., N. Mex.). Nucleonics 14, No. 1, 62-4(1956) Jan.

The techniques used in the preparation of an accurate C^{14} standard using benzoic acid are described. Benzoic acid was chosen as the standard material since it can be synthesized in high yield from CO_2 with no difficulties in the isolation and purification steps. (M.P.G.)

2832

STATISTICAL SPREAD IN PULSE SIZE OF THE PROPORTIONAL COUNTER SPECTROMETER. A. Bisi and L. Zappa (Istituto di Fisica Sperimentale del Politecnico, Milan, Italy). Nuovo cimento (10) 2, 988-94 (1955) Nov.

The pulse size distribution from monoenergetic radiations in a proportional counter was analyzed in the energy range between 2 and 70 kev. It is shown that the experimental data on total relative variances fit strictly to the relation: $\sigma_p/P = 0.138/E^{0.395}$. The spreads obtained are smaller than those resulting from Poisson's distribution. An attempt is made to deduce the relative variance in the number of initial electrons produced when the total energy of the primary particle is available for useful ionization. (auth)

2833

OBSERVATIONS OF NUCLEAR EMULSIONS IN REFLECTED LIGHT. R. Rechenmann (Laboratoire de Physique Corpusculaire de l'Universite de Strasbourg, France). Nuovo cimento (10) 2, 1104-6(1955) Nov. (In French)

A method is described for the casting and development of liquid nuclear emulsions on opaque supports for observations in reflected light. This method is used to study a granite from Monte Capanne. After development, observation with an "Ortholux" Leitz microscope equipped with an "ultropak" arrangement permits the localization and counting of the trajectories of α particles emitted by the minerals. (tr-auth)

2834

A NEUTRON DETECTION METHOD TO BE USED WITH

PULSE ACCELERATORS. F. Ferrero, R. Malvano, and C. Tribuno (Istituto Nazionale di Fisica Nucleare, Turin, Italy). Nuovo cimento (10) 2, 1135-6(1955) Nov.

A neutron detection system, based on the detection of β particles produced in the decay of Rh^{104} following neutron capture by Rh^{103} , is described. The system is presently being used in experiments on photoneutron angular distribution. The advantages of such a system are briefly discussed. (B.J.H.)

2835

A SEMI-CIRCULAR BETA-RAY SPECTROMETER FOR BETA-GAMMA COINCIDENCE MEASUREMENTS. E. F. De Hann and G. J. Sizoo (Vrije Univ., Amsterdam, Netherlands). Physica 21, 818-28(1955) Oct.

A semi-circular beta-ray spectrometer for coincidence measurements and the associated homogeneous magnet are described. Some operating data are given including that relevant to the measurement of branching ratios. (auth)

2836

AN OPTICALLY FOCUSING X-RAY DIFFRACTION CAMERA. A. Franks (Birkbeck Coll. Crystallography Lab., London). Proc. Phys. Soc. (London). B68, 1054-64(1955) Dec. 1.

An optically focusing x-ray-diffraction camera is used to obtain low angle diffraction photographs. Focusing is accomplished by total external reflection either by one elastically bent optical flat to form a line focus, or by two crossed flats to form a point focus. The beam is partially monochromatized and its intensity is high. Spacings greater than 600 Å have been resolved. (auth)

2837

A PRECISION CURVED CRYSTAL GAMMA-RAY SPECTROMETER. N. Ryde and B. Andersson (Chalmers Univ. of Technology, Göteborg, Sweden). Proc. Phys. Soc. (London) B68, 1117-31(1955) Dec. 1.

A curved crystal spectrometer of transmission type with a radius of curvature of one metre has been constructed, utilizing the (310) planes of quartz. The effective part of the crystal plate has the dimensions $10 \times 20 \times 1$ mm and subtends 0.00020 steradian at the focus. In order to ensure a high degree of stability the spectrometer is mounted on a strong U beam. The spectrum is scanned by moving a slit in front of the radiative source along the Rowland circle, the direction of the diffracted beam being fixed in space. The γ rays are detected by means of a NaI(Tl) scintillation crystal combined with a single channel pulse height discriminator. The wavelengths and energies of gamma rays from Au^{198} , As^{76} , Sb^{122} , Yb^{175} , Lu^{177} , Re^{186} , Re^{188} , Ir^{192} , and Ir^{194} , obtained by pile activation have been measured. (auth)

2838

THE DOSIMETRY OF BETA SOURCES IN TISSUE. THE POINT-SOURCE FUNCTION. Robert Loevinger (Mt. Sinai Hospital, New York). Radiology 66, 55-62(1956) Jan.

Problems associated with the dosimetry of β sources in tissue are reviewed. A mathematical function is presented for the calculation of point-source distribution. The extent to which this function fits available experimental data and the application of this function to β source distributed in tissue are discussed. (C.H.)

2839

ABSORPTION IN DIFFERENT TISSUES OF COBALT 60 GAMMA RADIATION AND ROENTGEN RAYS WITH HALF-

VALUE LAYERS FROM 1 mm. Al TO 5 mm. Cu. Lillian E. Jacobson and Isabelle Knauer (Montefiore Hospital, New York). Radiology 66, 70-83(1956) Jan.

The literature on absorption of radiation in tissue is reviewed. The absorption of x radiation and Co^{60} γ radiation was measured for muscle, fat, lung, compact bone, and spongy bone of beef. The method is described and results are plotted. The half-value layer, the linear coefficient of absorption, and the mass absorption coefficient are tabulated for each kv for the above tissues for field sizes of 7×7 cm, 5×5 cm, and of 2 cm diameter. The linear coefficient of absorption is plotted versus the equivalent kilovolts for the different tissues for a field 2 cm in diameter. Absorption in the various tissue types is discussed. (C.H.)

2840

AVERAGE ENERGY EXPENDED IN PRODUCING ION PAIRS— S^{35} ABSOLUTE VALUE FOR AIR. W. Gross, C. Wingate, and G. Failla (Columbia Univ., New York). Radiology 66, 101(1956) Jan.

An aqueous solution of $\text{Na}_2\text{S}^{35}\text{O}_4$ was used as one electrode of an extrapolation chamber in measurements of the S^{35} W value for air. (C.H.)

2841

LOSS OF ELECTRONS FROM COLLECTING ELECTRODE IN HIGH-ENERGY PHOTON BEAMS INVESTIGATED WITH A DOUBLE EXTRAPOLATION CHAMBER. Elizabeth F. Focht and Mary Louise Meurk (Memorial Center, New York). Radiology 66, 101-2(1956) Jan.

A double extrapolation chamber was designed in which the lower plate was made of a conducting plastic which could be increased in thickness, while the upper plate was increased in the usual way. The instrument was employed in an investigation of the loss of electrons observed from the high-energy photons of radiocobalt and betatron radiations. (C.H.)

2842

MODIFICATIONS OF DEPTH DOSE CURVES OF HIGH ENERGY X-RAY AND ELECTRON BEAMS BY INTERPOSED BONE. Lewis L. Haas and Glen H. Sandberg (Univ. of Illinois Coll. of Medicine, Chicago). Radiology 66, 102-4(1956) Jan.

Uniform bone plates of 0.5 and 1.0 cm thickness were prepared by hydraulic compression of bone powder to the density of living bone and were suspended in thin plastic sheets in a water phantom. A ratio recording system was used to compare the depth dose rate from high-energy x rays and electron beams in a stationary monitoring chamber with that of a small ionization chamber which was moved through the water phantom in step with the recorder chart motion. Results are presented graphically. (C.H.)

2843

HIGH RESOLUTION CRYSTAL SPECTROMETER FOR NEUTRONS. V. L. Sailor, H. L. Foote, Jr., H. H. Landon, and R. E. Wood (Brookhaven National Lab., Upton, N. Y.). Rev. Sci. Instr. 27, 26-34(1956) Jan.

A crystal spectrometer for neutron measurements has been developed which has relatively good resolution over an effective energy range from 0.08 to >20 ev. The figure of merit which has been obtained is $0.171 \mu\text{sec/m}$ with Be (1231) and $0.127 \mu\text{sec/m}$ with Be (2242) monochromator. The good resolution is made possible by a multiple channel collimator (Soller slit) of novel design. The collimator is

described in detail and the resolution function for the system is derived and discussed. It is shown that the resolution of the system is essentially independent of the mosaic spread of the crystal. Experimental results are presented which illustrate the performance of the instrument. (auth)

2844

ENERGY RESPONSE OF CsI TO PROTONS. A. Galonsky, C. H. Johnson, and C. D. Moak (Oak Ridge National Lab., Tenn.). *Rev. Sci. Instr.* **27**, 58-9(1956) Jan.

The pulse height in CsI crystal vs. incident proton energy curve is found to be linear for proton energies between 0.9 and 4.3 Mev. An advantage of the CsI crystal for proton detection is its nonhygroscopic nature. (C.W.H.)

2845

SOIL MOISTURE DETERMINATION BY A PORTABLE NEUTRON SCATTERING MOISTURE METER. J. F. Stone, D. Kirkham, and A. A. Read. *Soil Sci. Soc. Amer. Proc.* **19**, 419-23(1955) Oct.

A portable, battery-powered device for measurement of soil moisture by neutron scattering has been constructed and used for field measurements. The equipment, aside from being portable, differs from previously reported devices of this type as follows: (a) A fast neutron source in the form of an annulus is placed about the center of a slow neutron detecting tube; (b) Recently developed glow transfer tubes are used for absolute neutron count determinations; (c) A calibrating volume of paraffin, which is also used as a neutron shield, is incorporated as a part of the source-detector carrying case, to permit simple field checking and standardization of the device. The detector tube is partially shielded with cadmium to reduce the vertical extent of the soil "sample" contributing to the neutron count. Field data are presented. It was found, by locating the source-detector at various depths in pipes sunk vertically into the soil, that, except for the surface 6 to 9 inches, the equipment generally gave the soil moisture per unit soil bulk volume, within the range of the standard deviation of gravimetric determinations. A single calibration curve serves for all soils tested. The equipment weighs 45 pounds. The shielding protects the operator against radiation hazard and is sufficient for at least 8 hours per day use, 6 days a week. (auth)

2846

CERTAIN PROPERTIES OF A SPARK COUNTER FOR COUNTING α -PARTICLES. E. Andreeschchev and B. M. Isaev. *Soviet Phys. JETP* **1**, 212-17(1955) Sept. (In English). *Zhur. Eksptl. i Teoret. Fiz.* **28**, 3352-42(1955) Mar. (In Russian)

It is shown that, at the expense of a continuous corona discharge, a spark counter possesses self-stabilizing characteristics. Investigations were made on the counting characteristics in relation to their dependence on various electrode spacings and on the humidity. It is shown that the efficiency of the counting increases with increasing humidity. (auth)

2847

THE DECAY LAWS OF THE AFTERFLOW OF ZINC SULFIDE PHOSPHORS IN THE TEMPERATURE EXTINCTION REGION. F. I. Vergunas and N. L. Gasting (Siberian Physico-Technical Inst., Tomsk State Univ.). *Soviet Phys. JETP* **1**, 284-90(1955) Sept. (In English). *Zhur. Eksptl. i Teoret. Fiz.* **28**, 352-60(1955) Mar. (In Russian)

Results are presented of an investigation of the effect of temperature and intensity, as well as the length of excitation, on the decay law of the afterglow of some zinc sulfide phosphors near and in the extinction region. (auth)

MESONS

2848 AEC-tr-2371

THE SEMIPHENOMENOLOGICAL THEORY OF π -MESON-NUCLEON INTERACTIONS. I. π -MESON SCATTERING BY NUCLEONS. I. E. Tamm, Yu.(U.) A. Gol'fand (Golfbrand), and V. (B.) Ya.(J.) Fainberg (Feinberg). Translated by Michael B. Karelitz from *Z. Eksptl. i Teoret. Fiz.* **26**, 649-67(1954). 36p.

The theory is based on the assumption that the nucleon is (apart from its basic state) in an excited (isobaric) state, of which the ordinary and the isotopic spin are $\frac{3}{2}$. The theory is relativistically invariant. The problem of π -meson scattering by nucleons is investigated when damping is considered. By means of proper selection of four independent parameters entering in the theory, it is possible to obtain a satisfactory agreement with experimental data for the angular distribution of scattered π mesons as well as for the total cross section-energy relationship in the entire interval of energies under investigation. (auth)

2849

OBSERVATION OF FORMATION AND DECAY OF UNSTABLE PARTICLES IN EMULSION CHAMBERS. V. V. Alpers, R. I. Gerasimova, I. I. Gurevich, A. P. Mishakova and L. B. Surkova. *Doklady Akad. Nauk S.S.S.R.* **105**, 236-9(1955) Nov. 11. (In Russian)

Track tracings of unstable particles were recorded on emulsion film. Gases of associated stars were studied to find K^- mesons associated with Λ^0 and other particles. Investigations of 4-prong stars to find τ mesons and 2-prong stars to find hyperons were made. 398 tracks of π mesons were measured, 214 of which were formed inside of the emulsion chambers. An area of emulsion of 20cm² was analyzed. (R.V.J.)

2850

ON SPIN AND PARITY OF THE τ MESON. I. I. Gurevich and A. P. Mishakova. *Doklady Akad. Nauk S.S.S.R.* **105**, 451-3(1955) Nov. 21. (In Russian)

A general review of previous experiments of various authors are analyzed with the view of determining the value of the τ -meson spin and parity. (R.V.J.)

2851

ISOTOPIC INVARIABILITY OF π -MESON FIELD. A. M. Baldin (Lebedev Inst. of Physics) *Izvest. Akad. Nauk S.S.S.R. Ser. Fiz.* **19**, 604-5(1955) Sept.-Oct. (In Russian)

The studies of the elastic photoproduction reactions $\gamma + d \rightarrow d + \pi^0$; $\gamma + \text{He}^4 \rightarrow \text{He}^4 + \pi^0$; $\gamma + \text{C}^{12} \rightarrow \text{C}^{12} + \pi^0$ etc. have confirmed the hypothesis of the π -meson field isotopic invariability. (R.V.J.)

2852

PHOTOPRODUCTION OF NEUTRAL π MESONS FROM DEUTERONS. A. S. Belousov, A. V. Kutsenko, and E. I. Tamm. *Izvest. Akad. Nauk S.S.S.R. Ser. Fiz.* **19**, 605-6(1955) Sept.-Oct. (In Russian)

The cross sections for photoproduction of π^0 mesons from d, He⁴, and C¹² and other nuclei, with or without disintegration of the nucleus, have been proven to be of the same magnitude. The experimental studies of the

photoproduction of π^0 mesons from deuterons: $\gamma + d \rightarrow$

$\begin{cases} d + \pi^0 \\ p + n + \pi^0 \end{cases}$, made with the γ rays of the 250-Mev synchro-

tron, gave similar cross sections for both reactions, confirming the hypothesis of the π -meson field isotropic invariability. (R.V.J.)

2853

AN ANALYSIS OF TWO τ -MESON DECAYS. Kuni Imaeda and Mitsuko Kazuno (Yamanashi Univ., Japan). *J. Phys. Soc. Japan* 11, 85-7(1956) Jan.

Data on the decay of two τ mesons, decaying in nuclear emulsions, are summarized. (B.J.H.)

2854

ON THE MASSES AND MODES OF DECAY OF HEAVY MESONS PRODUCED BY COSMIC RADIATION. (G-STACK COLLABORATION). J. H. Davies, D. Evans, P. E. Francois, M. W. Friedlander, R. Hillier, P. Iredale, D. Keefe, M. G. K. Menon, D. H. Perkins, and C. F. Powell (H. H. Wills Physical Lab., Bristol); J. Bøggild N. Brene, P. H. Fowler, J. Hooper, W. C. G. Ortel, and M. Scharif (Institut for Teoretisk Fysik Copenhagen); L. Crane, R. H. W. Johnston, and C. O'Ceallaigh (Institute for Advanced Studies, Dublin); F. Anderson, G. Lawlor, and T. E. Nevin (Univ. Coll., Dublin); G. Alvial, A. Bonetti, M. di Corato, C. Dilworth, R. Levi Setti, A. Milone (+), G. Occhialini (*), L. Scarsi, and G. Tomasini (+) (+ Istituto di Fisica dell'Università, Genoa; Istituto di Scienze Fisiche dell'Università, Milan; Istituto Nazionale di Fisica Nucleare, Milan; and *Université Libre, Brussels); and M. Ceccarelli, M. Grilli, M. Merlin, G. Salandini, and B. Sechi (Istituto di Fisica dell'Università, Padua and Istituto Nazionale di Fisica Nucleare, Padua). *Nuovo cimento* (10) 2, 1063-1103(1955) Nov.

A large emulsion stack, exposed at high altitude, has been used to study the decay modes of K particles which produce a single charged secondary. The 5 decay modes, K_s , χ , \mathcal{K} , K_0 , and τ' have been recognized from the nature and energy of the charged secondary. The masses of the parent particles of the two-body decay modes, K_μ and χ found from the mean range of the charged secondary are $(976 \pm 7) m_e$ and $(969 \pm 3) m_e$ respectively. Independent values derived from measurements of the scattering of the secondary track near the decay point are $(954 \pm 17) m_e$ and $(972 \pm 15) m_e$ respectively. The reliability of these mass values is discussed. An examination of the relative frequency of the decay modes in these experimental conditions indicates that the K_μ and χ modes constitute respectively about 67% and 20% of all the K-particle decays; the K_0 , \mathcal{K} and τ' modes being present to about 9%, 3%, and 1% respectively. (auth)

2855

PHENOMENOLOGICAL ANALYSIS OF ELASTIC π^-p SCATTERING AT 1.4 BEV. Daisuke Ito and Shigeo Minami (Univ. of Education, Tokyo and Osaka City Univ., Japan). *Progr. Theoret. Phys. (Japan)* 14, 198-202(1955) Sept.

Pion-proton scattering at 1.4 BeV is analyzed in a phenomenological way. Interpreting the peak in the forward direction as "shadow scattering" and analyzing this angular distribution, a result is obtained which agrees fairly well with the experimental value. By this method, moreover, it is found that the partial waves of $l = 0, 1, 2$, and $l = 1, 2, 3, 4$ are mainly responsible for the elastic and production cross sections respectively. (auth)

2856

HEAVY MESONS. M. S. Sinha (Bose Inst., Calcutta). *Trans. Bose Research Inst. Calcutta* 20, 127-44(1955).

Experimental evidences of the existence of mesons in the cosmic rays, heavier than π^- and μ^- mesons are reported. Properties of the various types of the heavy mesons are discussed. (auth)

2857

ENERGY DEPENDENCE OF THE SPECIFIC IONIZATION OF RELATIVISTIC μ MESONS. J. Buschmann (Max Planck Inst. for Physics, Göttingen, Germany). *Z. Naturforsch.* 10a, 680-7(1955) Sept.-Oct. (In German)

The experimental proof of the so called logarithmic gradient of ionization, postulated by Bethe-Bloch theory, was not satisfactorily extended to particles heavier than electrons until a few years ago. A μ -meson beam was defined by means of a Geiger-Mueller counter telescope, and the count of the inner argon-filled proportional counter determines the ion pairs produced as a function of the range of the μ mesons. The discussion of the possible error, treated by this analysis, shows that the selected method of measurement to determine the mean energy losses described by the Bethe-Bloch equation is somewhat unsuitable, since the most probable, that is, the most frequently occurring energy loss defines itself. The theoretically expected logarithmic gradient of the meson energy is confirmed by agreement with numerous recent experiments. This result stresses the importance of ionization measurements with proportional counters for the determination of higher energy particles. (tr-auth)

Refer also to abstract 2954.

NEUTRONS

2858 NRL-4673

Naval Research Lab., Washington, D. C.

MONTE CARLO REACTOR CALCULATION. S. Podgor and L. A. Beach. Nov. 11, 1955. 10p. Project NR 664-020.

The Monte Carlo method has been used to estimate the slowing down of fast neutrons in a spherical homogeneous mixture of U^{235} and H_2O . The estimated probability distribution of thermalization was compared favorably with those of other calculational methods and with experimental measurements. These probability distributions were used to calculate the critical ratio of U^{235} to H_2O for both bare and reflected core reactors. (auth)

2859

YIELD OF PHOTONEUTRONS FROM U^{235} FISSION PRODUCTS IN BERYLLIUM AND DEUTERIUM. S. Bernstein, W. K. Ergen, F. L. Talbott, J. K. Leslie, and C. P. Stanford (Oak Ridge National Lab., Tenn.). *J. Appl. Phys.* 27, 18-22(1956) Jan.

The yield of photoneutrons from a sample of U^{235} fission products at the center of a 9-in. diameter Be sphere was measured. Samples of U^{235} were exposed to neutrons in the reactor for periods of 15 min, 6 hr, and 74 hr. The photoneutrons created by the fission product gamma rays acting upon the Be nuclei were observed from 0.3 sec to about 4 weeks after the end of the exposure. Curves showing the photoneutron yield as a function of time, relative to the delayed neutron yield, are given for these exposure and observation times. The attempt was made to account for

the observed yields from Be in this experiment, and the yield from D₂O observed in an earlier experiment, in terms of known fission product gamma emitters. (auth)

2860

PHOTONEUTRONS FROM U²³³ AND Pu²³⁹ FISSION PRODUCTS IN HEAVY WATER. S. Bernstein, J. K. Leslie, C. R. McKinney, and H. K. Jackson (Oak Ridge National Lab., Tenn.). *J. Appl. Phys.* **27**, 23-4(1956) Jan.

The yield of photoneutrons from U²³⁵, U²³³, and Pu²³⁹ fission products in heavy water were compared. The number of photoneutrons per delayed neutron was found to be approximately the same for all three, in spite of the previously known large variations in the relative numbers of delayed neutrons from these isotopes. (auth)

2861

THERMAL FLUX DISTRIBUTION FROM A FAST NEUTRON LINE SOURCE. G. W. Stuart (Hanford Atomic Products Operation, Richland, Wash.). *J. Appl. Phys.* **27**, 89-90(1956) Jan.

The spatial distribution of thermal neutrons originating from a fast neutron line source, with slowing down described by age theory, and thermal percolation through an infinite, isotropic medium described by diffusion theory, is presented. (auth)

2862

ON THE NEUTRONS FROM THE N¹⁴(d,n)O¹⁵ REACTION. Itaru Nonaka, Susumu Morita, Nawoyuki Kawai, Toshiyuki Ishimatsu, Shigeru Suematsu, Kenji Takeshita, Yutaka Nakajima, and Yoshihisa Wakuda (Kyushu Univ., Fukuoka, Japan). *J. Phys. Soc. Japan* **11**, 1-7(1956) Jan.

The energy spectrum and the angular distribution of the neutrons from the N¹⁴(d,n)O¹⁵ reaction were investigated by the photographic plate method. The energy of the bombarding deuterons was 1.85 Mev, and the Q-value corresponding to the ground state of O¹⁵ nucleus was obtained to be (5.21 ± 0.07) Mev. The low energy neutron group corresponding to the first excited state of O¹⁵ nucleus was also observed, but it overlapped with the contaminated C¹²(d,n)N¹³ neutrons and the accurate Q-value could not be determined. The estimated rough value was about -0.1 Mev. The angular distribution of the high energy neutron group has a maximum at about 20 degrees (c.m.s.) and decreases considerably beyond this maximum, indicating the stripping process corresponding to l_p = 1. This reaction may be a good source of neutrons of about 7 Mev at the bombarding energies of deuterons below 2 Mev. (auth)

2863

ACTIVATION BREAKDOWN OF INDIUM FOILS IN A NEUTRON FIELD. H. Meister (Max Planck Inst. for Physics, Göttingen, Germany). *Z. Naturforsch.* **10a**, 669-80 (1955) Sept.-Oct. (In German)

The activation breakdown of circular indium foils in a thermal neutron field was measured for paraffin and graphite scattering media by comparison of the activity in the medium with that in a sufficiently large cavity. The measured breakdown obeys elementary diffusion theory in the geometrical relationship, departing therefrom in absolute values. The activation breakdown in paraffin is in agreement with the rules of Corinalesdi. (tr-auth)

2864

CALCULATION OF THE ENERGY DISTRIBUTION FUNCTION OF NEUTRONS BY MARKOV'S METHOD. V. V. Chavchanidze and O. D. Cheitvili (Tbilisi State

Univ.). *Soviet Phys. JETP* **1**, 375-6(1955) Sept. (In English). *Zhur. Eksptl. i Teoret. Fiz.* **28**, 369-70(1955) Mar. (In Russian)

Refer also to abstract 2909.

NUCLEAR PHYSICS

2865

A MODIFICATION OF THE ONE-PARTICLE FORMULA FOR NUCLEAR GAMMA-RADIATION. P. R. Wallace (McGill Univ., Montreal, Quebec). *Can. J. Phys.* **34**, 62-8(1956) Jan.

The one-particle theory of isomeric γ transitions in nuclei consistently over estimates the probability per unit time of decay. It is shown that, by modifying the one-particle model to take account of the readjustment of the wave functions of all the nuclear particles during the predominantly one-particle transition, satisfactory agreement with experiment can be obtained. The fact that odd-proton transitions are depressed more than odd-neutron ones is attributed to the exchange character of the force giving rise to the readjustment. (auth)

2866

ISOTOPE SHIFTS AND NUCLEAR CHARGE DISTRIBUTIONS. A. S. Reiner. (Univ. of Amsterdam, Netherlands). *Physica* **21**, 783-95(1955) Oct.

A general expression for the isotope shift is given. Compared with previous treatments a decrease of the volume shift resulted for a homogeneous charge distribution. Modelfactors for various classes of charge distributions are given for the volume and the distortion shift. The effect of nuclear compressibility is revised. The testcase Pb is investigated and a tentative discrimination between different charge distributions leads to a homogeneous charge distribution with small deviations of the density in the surface region. (auth)

2867

INFLUENCE OF THE STATISTICAL FACTOR ON (d,p) CROSS SECTIONS. P. M. Endt and C. M. Braams (Rijksuniversiteit, Utrecht, Netherlands). *Physica* **21**, 839-40(1955) Oct.

It is pointed out in this note that the Butler formalism successfully explains the observed relative intensities of proton groups from different (d,p) reactions, which necessitates the use of the full expression $(2J_f + 1)/(2J_i + 1)$, corrected for the partial filling of the relevant neutron shell. Cross sections for (d,p) reactions with even-even initial nuclei tend to be relatively large, especially so if the neutron number of the initial nucleus is magic. (L.M.T.)

2868

THEORY OF DIRECT INTERACTIONS IN NUCLEAR REACTIONS. Satio Hayakawa (Kyoto Univ., Japan). *Trans. Bose Research Inst. Calcutta* **20**, 21-6(1955).

The direct interaction with regard to nucleon scattering and the stripping pick-up reaction is reported. The formulation is presented for emphasizing physical implications. (auth)

NUCLEAR PROPERTIES

2869 AEC-tr-2370

AN INVESTIGATION OF THE SPIN-ORBITAL SPLITTING

OF THE He^5 LEVELS IN THE SCATTERING OF POLARIZED NEUTRONS BY He^4 . I. I. Levintov, A. V. Miller, and V. N. Shamshev. Translated from *Doklady Akad. Nauk S.S.S.R.* 103, 803-6(1955), 6p. Available from Associated Technical Services (Trans. 36G8R), East Orange, N.J.

2870

NOTE ON THE $T = \frac{3}{2}$ STATE IN N^{15} . G. A. Bartholomew, A. E. Litherland, E. B. Paul, and H. E. Gove (Atomic Energy of Canada Ltd., Chalk River, Ontario). *Can. J. Phys.* 34, 147(1956) Jan.

A newly reported Q -value for the $\text{C}^{14}(\text{d},\text{p})\text{C}^{15}$ reaction indicates that the $T = \frac{3}{2}$ state in N^{15} corresponds to the ground state in C^{15} rather than an excited state as has been previously reported. (D.E.B.)

2871

IONIZATION OF THE K SHELL OF VARIOUS ELEMENTS BY α PARTICLES. Radha Raman Roy, Alphonse Lagasse, Marie-Louise Goes, and Jacqueline Diltoer. *Compt. rend.* 241, 1749-51(1955) Dec. 14. (In French)

The ionization of the K shell of Cu was studied as a function of α -particle incident energy. The relative intensity of x-ray emission from the K shell was studied for different elements. The results were compared with Henneberg's theory. (tr-auth)

2872

ON THE WIDENING IN QUADRUPOLE RESONANCE DUE TO IMPURITIES. Bernard Dreyfus and Daniel Dautreppe. *Compt. rend.* 241, 1751-3(1955) Dec. 14. (In French)

The widening, verified by the effect of the elastic constants of impurity molecules on the dynamic properties of the crystal lattice, is interpreted. (tr-auth)

2873

SCREENING COEFFICIENTS FOR DEEP LEVELS OF HEAVY ATOMS ($Z > 60$). William Laskar. *Compt. rend.* 241, 1753-5(1955) Dec. 14. (In French)

For the deeper levels of heavy elements, the screening coefficients are calculated by the statistical Thomas-Fermi method. The values obtained are compared to the values deduced from the experimentally measured energy levels, and to the calculations of J. R. Reitz. (tr-auth)

2874

NUCLEAR MAGNETIC RESONANCE IN WEAK FIELDS. I. A HERTZIAN SPECTROSCOPE FOR OBSERVATION OF THE RESONANCE BETWEEN 15 AND 2 Kc/s. Claude Manus, Georges Béné, Richard Extermann, and Robert Mercier (Univ. of Geneva, Switzerland). *Helv. Phys. Acta* 28, 617-25(1955) Dec. (In French)

The different elements are described in detail, particularly the resonance source, the principal part of the apparatus. The signal-to-noise ratio of the complete equipment is calculated and compared to experimental values. (tr-auth)

2875

NUCLEAR MAGNETIC RESONANCE IN WEAK FIELDS. II. STUDY OF NUCLEAR MAGNETIC RESONANCE BETWEEN 2 AND 0.5 GAUSS. Bernard Cagnac, Claude Manus, Georges Béné, and Richard Extermann (Univ. of Geneva, Switzerland). *Helv. Phys. Acta* 28, 626-32(1955) Dec. (In French)

The previously described equipment was used for the study of proton resonances. The form of the resonance curves is examined in detail as a function of such vari-

ables as the amplitude of the high-frequency field and the characteristics of the sweep field. The diagrams are given near the minimum frequency used, at about 2 kc/s. (tr-auth)

2876

HYPERFINE STRUCTURE OF THE SPECTRUM OF RUTHENIUM. PART III. Kiyoshi Murakawa (Institute of Science and Technology, Tokyo). *J. Phys. Soc. Japan* 10, 919-26(1955) Nov.

The hyperfine structure of the spectrum of Ru I was studied, and it was found that the ratio of the distances of the components due to the even isotopes is given by $\Delta(104-102) : \Delta(102-100) : \Delta(100-96)/2 = 1 : 1.05 \pm 0.10 : 0.75 \pm 0.15$. There is reason to suppose that the shift $\Delta(98-96)$ is anomalously small compared with the shift $\Delta(104-102)$ or $\Delta(102-100)$. The magnetic moments of the odd isotopes were calculated to be $\mu(\text{Ru}^{101}) = -0.69 \pm 0.15$ nm. and $\mu(\text{Ru}^{99}) = -0.63 \pm 0.15$ nm. (auth)

2877

THE QUADRUPOLE MOMENT OF La^{139} . Kiyoshi Murakawa (Institute of Science and Technology, Tokyo). *J. Phys. Soc. Japan* 10, 927-9(1955) Nov. (cf. NSA 8-5682)

The hyperfine structure of the spectra of La I and La II was studied, and data that are more accurate than the previous investigation were obtained. These data, together with an improved value of the screening correction of the d electron, yielded the result that the quadrupole moment of La^{139} is $(0.6 \pm 0.2) \times 10^{-24}$ cm², in which the polarization correction due to Sternheimer is taken into account. (auth)

2878

OBSERVATION OF NUCLEAR QUADRUPOLE RESONANCES WITH A COAXIAL-CAVITY SPECTROMETER. Shoji Kojima, Akira Shimauchi, Shigeo Hagiwara, and Yoshihito Abe (Tokyo Univ. of Education). *J. Phys. Soc. Japan* 10, 930-6(1955) Nov.

A super-regenerative spectrometer with a two-cavity grid-separation oscillator of a lighthouse tube was constructed and operated in the frequency region between 700 and 1000 Mc. With this spectrometer, nuclear quadrupole resonances of I^{127} in solid NH_4I_3 and ICl were observed. The coupling constants for NH_4I_3 and ICl were 2440 and 3008 Mc at room temperature and the asymmetry parameters were 1.8 and 2.0 %, respectively. (auth)

2879

INVESTIGATION OF MAGNETIC MOMENTS OF ATOMIC NUCLEI. P. S. Faragó, M. Gécs, and J. Mertz (Central Research Inst. of Physics, Budapest). *Nuovo cimento* (10) 2, 1110-13(1955) Nov.

Measurements of the nuclear magnetic moments of Na^{23} , P^{31} , and F^{19} were repeated. The results are summarized and compared with those of other authors. (B.J.H.)

2880

CALCULATION OF ISOTOPE SHIFTS IN THE SPECTRUM OF HELIUM. A. P. Stone (Clarendon Lab., Univ. of Oxford, England). *Proc. Phys. Soc. (London)* A68, 1152-6(1955) Dec. 1.

The isotope shift due to nuclear motion is calculated for 2^1S , 2^3S terms of helium, using wave functions which take account of configuration interaction. Agreement is obtained with the experimental term shifts within the limits of experimental error. It is concluded that isotope shifts in helium are due mainly to nuclear motion. (auth)

2881

THE SHORT LIVED ISOBARS Mo^{106} AND Tc^{105} . J. Flegenhaimer, G. B. Baró, and A. Medina (Comisión Nacional de la Energía Atómica, Buenos Aires). *Z. Naturforsch.* **10a**, 798-9(1955) Sept.-Oct. (In German)

Refer also to abstracts 2748, 2852, and 2951.

NUCLEAR REACTORS

2882 AECL-240

Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.

THE PRELIMINARY DESIGN FOR NPD. H. A. Smith. Oct. 1955. 25p.

General discussions are given on the preliminary design work and economic factors of a demonstration nuclear-electric power plant (NPD) which is to be constructed soon in Canada. (B.J.H.)

2883 AECU-3136

Knolls Atomic Power Lab., Schenectady, N. Y.

FREE CONVECTION IN THE SIR MARK A ROTATING PLUGS. D. P. Timo. Nov. 12, 1953. 36p. Contract [W-31-109-Eng-52]. (MEMO-DPT-5)

A brief description is given of the free convection problem existing in the various annuli of the SIR Mark A rotating plugs. It is by no means a complete report on the plug "hot tests," but merely records some of the more significant experimental observations and presents a few of the theories and calculations made to explain the observed free convection phenomena. The general discussion which follows is chronological. Details of analyses are relegated to the Appendix. (auth)

2884 BNL-2465

Brookhaven National Lab., Upton, N. Y.

LATTICE PARAMETERS FOR LIGHT WATER, SLIGHTLY ENRICHED URANIUM REACTORS. Jack Chernik. [Oct. 1953]. Decl. Nov. 4, 1955. 13p. \$3.30(ph OTS); \$2.40 (mf OTS).

Equations are given for the probability of a neutron slowing down past the fission threshold. Data are also summarized on the probability of the first neutron collision with U^{238} - H_2O fuel assemblies and on a comparison of the fast fission factor for homogeneous, slab, and rod fuel assemblies. Diffusion theory and experimental flux data for the moderator of U - H_2O assemblies are compared. (B.J.H.)

2885 CRRP-626

Atomic Energy of Canada, Ltd. Chalk River Project, Chalk River, Ont.

FISSION PRODUCT POISONING. W. H. Walker. Jan. 5, 1956. 7p.

This paper prepared for the Reactor Core Conference, January 9 to 12, 1956.

A survey of fission product accumulation and poisoning in reactor fuels at Chalk River was completed. Calculations of the poisoning by U^{235} fission products are shown. (B.J.H.)

2886 IDO-16022

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

BEHAVIOR OF THE Xe CONCENTRATION IN THE MTR AFTER A POWER REDUCTION. J. W. Webster. [nd].

Decl. Sept. 28, 1955. 14p. Contract [AT(10-1)-205].

The results of a numerical investigation of the behavior of the Xe concentration in the MTR is presented. (Xenon is a fission product with a very large capture cross section for neutrons and is hence very detrimental in using up excess reactivity that would otherwise contribute to the lifetime of the fuel loading.) Curves are attached showing the growth of the Xe concentration after various power reductions from full and part power. The time of the maximum transient Xe concentration and the time at which the Xe returns to its original steady state concentration are studied in some detail. (auth)

2887 IDO-16036

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

THE DETERMINATION OF U^{235} BURN-OUT IN FUEL RODS. M. W. Holm. Feb. 2, 1953. Decl. Sept. 28, 1955. 20p. Contract AT(10-1)-205.

A method is devised for determining the extent of the depletion of fissionable material in fuel and shim rods. Relationships between fuel depletion, thermal flux history, and gamma-radiation production were investigated. It is shown that if the thermal flux in a volume element during reactor operation is $\phi(t) = \sum a_i t^i$, the burn-out is $100 \{1 - \exp [-(\sigma_f + \sigma_a) \sum a_i t^{i+1}/(i+1)]\} \%$ where σ_f and σ_a are the microscopic fission and capture cross sections; if $\gamma(\tau)$ is the γ energy in Mev per second per fission τ seconds after fission, the γ energy radiated by a volume element dV is $\sigma_f dV N_0 \int_0^{T_0} \sum a_i t^i \cdot \exp [-(\sigma_f + \sigma_a) \sum a_i t^{i+1}/(i+1)] \gamma(T-t) dt$, where N_0 is the number of fissionable nuclei per cm^3 originally present, T_0 is the time of reactor shutdown, and T is the time of γ -intensity measurement; if dE_j is the γ intensity measured at time T_j , and if p such measurements are made, the number of fissioned nuclei in dV can be approximated by solving for n_i ($i = 1, 2, 3 \dots p$) the p simultaneous equations, $dE_j = \sum_{i=1}^p n_i \gamma [\Gamma_j - \sum_{n=1}^i (\Delta t)_n]$, ($j = 1, 2, 3 \dots p$) and summing the n_i . $\sum_{n=1}^p (\Delta t)_n = T_0$

(The period of reactor operation is divided up into p equal sub-intervals of length Δt ; n_i is then the number of nuclei fissioning during Δt_i); and it is possible to estimate what fraction of the total burn-out can be attributed to any particular fuel or shim rod by simultaneously measuring the γ intensity of each fuel and shim rod as a function of axial position and comparing the area under a given curve with the total area under all such curves. (auth)

2888 IDO-16095

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

WEIGHTING FUNCTIONS FOR CALCULATING REACTIVITY PERTURBATIONS IN THE MTR. J. W. Webster. May 14, 1953. Decl. Sept. 28, 1955. 26p. Contract AT(10-1)-205.

Weighting functions are often needed for the purpose of calculating the effect on reactivity of non-uniform changes in the composition of the core or reflector of the MTR. In this report the flux distributions, adjoint flux distributions, and the weighting functions are computed and graphed for the MTR with 3×9 array of 140 g fuel elements and 110 g shim fuel sections. The calculations are made in the N-S,

E-W, and vertical directions using the slab type geometry and then the approximation is made that $\phi(x,y,z) \propto \phi(x)\phi(y)\phi(z)$. The weighting function for pure absorber and the thermal fluxes are compared with experimental results and the agreement is found to be reasonably good. The calculated weighting function for pure absorber is compared with that for fuel and they are found to be somewhat different. The absorber statistical weight falls off more sharply for the outer fuel elements compared to the center than does the statistical weight for fuel. (auth)

2889 IDO-16100

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

THE LOW CROSS-SECTION FISSION PRODUCT POISONS. J. W. Webster. June 8, 1953. Decl. Sept. 12, 1955. 37p. Contract AT(10-1)-205.

Data compiled at the Chalk River Project and in the G. E. Chart of Nuclides are used to compute the build-up of low cross section fission product poisons and their effect on the reactivity of the MTR for different fluxes. It is found that the plot of the accumulation of the low cross section fission product poisons is roughly linear with time, but has considerable curvature for low nvt's because the products of relatively large cross section quickly saturate. The curve again has some curvature for large nvt's when the relatively low cross section poisons approach saturation. The most serious low cross section fission product poisons in the MTR with the present nvt's obtained are Nd^{143} , Sm^{151} , the I^{131} - Xe^{131} chain, Tc^{99} , Rh^{103} , and U^{236} . The ratio of the reactivity effect due to fuel burn-up to the low cross section fission product poison effect is about 7 to 1 in the MTR. This ratio would be even higher for larger nvt's. It seems the low cross section fission product poisons will never be a limiting problem in achieving higher nvt's in reactors of the fixed fuel type. The problems of getting more and more usable fuel into the fuel elements to offset burn-up, problems of high percentage burn-up, heat removal, etc., seem to be more of a limitation. (auth)

2890 IDO-16105

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

FUEL BURNUP DETERMINATIONS BY GAMMA-RAY SCANNING. S. G. Forbes and W. E. Nyer. Oct. 16, 1953. Decl. Sept. 12, 1955. 15p. Contract AT(10-1)-205.

The practical accuracy of a method for determining fuel burnout by measuring the gamma-ray intensity from the fission products is investigated. The detection problem, the effect of variable flux history, and the effect of multiple cycling are considered in detail. The limits of the errors introduced by various perturbing factors are calculated or estimated, and procedures are recommended for reduction of errors where possible. (auth)

2891 IDO-16161

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

EVALUATION OF FUEL LOADINGS AND CYCLE TIMES FOR THE MTR. C. F. Leyse. Apr. 6, 1954. Decl. Sept. 21, 1955. 32p. Contract AT(10-1)-205.

A comparison of MTR fuel fabrication costs for various conditions shows that the effects of shim rod service, fuel plate cladding thickness, reactor core geometry, reactor cycle time, and reactor power on these costs are all reduced by increasing the fuel content per fuel assembly.

Although a two-week cycle is generally more economical than a three-week cycle, the impending change from the two-week cycle with 168-gram fuel assemblies to a three-week cycle with 200-gram fuel assemblies should show a saving of 3 to 4.8 \$/MWD (megawatt-day). Supplementary information regarding fuel burnup and the requirements as to number of fuel assemblies is included. (auth)

2892 IDO-16182

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

GRAPHITE DAMAGE AS AN INDEX TO THE INTEGRATED DAMAGING NEUTRON FLUX. E. Fast. Sept. 28, 1954. Decl. Sept. 12, 1955. 25p. Contract AT(10-1)-205.

Radiation damage in CS-GBF graphite, as measured by changes in electrical resistivity, crystallite C_0 spacing, physical dimensions, and stored energy, has been related empirically to the fast neutron flux above 1 Mev. The purpose of this work was to evaluate several properties of graphite as a possible index to damaging neutron flux in radiation damage studies. A brief summary of useful nvt range and standard deviation of points from the best-fit curve is presented. In addition to having the best reproducibility, x-ray measurement of C_0 spacing covers the range most frequently encountered in in-tank exposures at the MTR. Augmented by electrical resistivity and dimensional measurements, made on the same samples, both lower and higher exposures can be read. Graphite radiation damage as a flux monitor has the advantage of giving a value proportional to total damaging nvt. The relatively low activation even for very high exposures, allows handling or irradiated specimens without special shielding. (auth)

2893 IDO-16208

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

FLAT VERTICAL POWER DISTRIBUTION FOR THE MTR. J. W. Webster. Mar. 24, 1955. Decl. Sept. 28, 1955. 55p. Contract AT(10-1)-205.

Two-group reactor equations are solved for the 2 cases of flat vertical power distribution and flat vertical distribution of thermal flux. A distribution of U and burnable poison is determined for the MTR to give flat vertical power at startup and approximately throughout a 4-week cycle. The amounts of B and Gd needed for burnable poisons are calculated. With a flat vertical power distribution, the MTR power can be increased to ~46 Mev without exceeding the present peak power density under the idealization that the reactor can be operated with no available excess reactivity. (M.P.G.)

2894 IDO-16251

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

METHOD FOR MAKING MEASUREMENTS IN THE RMF. J. W. Webster. June 25, 1954. Decl. Aug. 30, 1955. 13p. Contract AT(10-1)-205. (MTRL-54-51)

Preliminary thoughts and calculations on the theoretical aspects of making measurements in the Reactivity Measurement Facility are summarized. Attention is given to ways of separating the effects of fuel and poison and to accuracy and sensitivity. (auth)

2895 NARF-55-83T

CONVAIR. Fort Worth, Tex.

MAINTENANCE OF A. S. T. R. GROUND HANDLING

EQUIPMENT. Dec. 23, 1955. 183p. Contract AF-33(038) 21117. (FSE-9-007).

The description and maintenance data are given for the major items of the ASTR ground handling equipment, including the ASTR rotator, the remote hook, the lifting yoke and power dolly, and the loading platform. (B.J.H.)

2896 NCSC-124

North Carolina State Coll., Raleigh.

NEUTRON FLUX MEASUREMENTS IN THE RALEIGH RESEARCH REACTOR. Arthur Waltmer. Sept. 1955. 17p. Contracts DA-36-034-ORD-1656.

2897 NEI-51

Atomic Energy of Canada Ltd. Chalk River Project, Project, Chalk River, Ont.

NOTES ON THE USE OF DOWTHERM 'A' AS A REACTOR COOLANT. J. Howieson. Apr. 21, 1955. 6p.

Dowtherm 'A' has been suggested as a reactor coolant. Inquiries and calculations indicate its use must be strictly limited. (D.E.B.)

2898

SOME NOTES ON THE THEORY OF THERMAL-NEUTRON REACTORS. J. D. Stewart (Atomic Energy of Canada Ltd., Chalk River, Ontario). *Can. J. Phys.* 34, 20-3(1956) Jan.

Equations for the asymptotic steady-state distribution of neutrons in homogeneous and lattice-type reactors are derived without making any assumptions about the mechanism of diffusion, except the obviously necessary one that the probability for a neutron which is born at one given point to be captured at a second given point is a function only of the distance between these two points. The equations are seen to be of a form that admits of exponential solutions, these are written down, and equations for the Laplacians are derived. A clear-cut definition of the migration area of a lattice reactor is given and it is pointed out that in a reactor of this type there is no unique value of the Laplacian but rather a range of values. (auth)

2899

GAMMA-RAY DOSAGE IN INHOMOGENEOUS NUCLEAR REACTORS. W. Primak (Argonne National Lab., Lemont, Ill.). *J. Appl. Phys.* 27, 54-62(1956) Jan.

Methods for estimating the gamma-ray dosage in samples undergoing irradiation in nuclear reactors are developed. They are applied to the calculation of the dosage in inhomogeneous reactors using CP-3 and X-10 as examples. The examples include a calculation of the heating which results from the absorption of gamma rays and of the chemical reaction which results from the absorption of gamma rays. The non-uniformity of the gamma-ray dosage in bodies undergoing irradiation is demonstrated and estimated. The results show that in nuclear reactors the gamma-ray dosage varies very greatly depending on the experimental arrangements and that, in particular cases, the major contribution to the dosage can arise from any of the following individual sources or some combination of them: the material being irradiated, the containers, the structural members of the irradiation facility, the moderator, or the fuel. (auth)

2900

PREDICTING REACTOR TEMPERATURE EXCURSIONS BY EXTRAPOLATING BORAX DATA. William K. Luckow and Lawrence C. Widdoes (Univ. of Michigan, Ann Arbor). *Nucleonics* 14, No. 1, 23-5(1956) Jan.

Data on the nature and limitations of power excursions

in water-cooled, -moderated, and -reflected reactors were obtained in the "Borax" experiments. These data were extrapolated to predict the transient behavior of the Univ. of Michigan swimming-pool-type research reactor. Methods of extrapolation are described, and results are summarized. (M.P.G.)

Refer also to abstract 2744.

NUCLEAR TRANSFORMATION

2901 AEC-tr-2380

PHOTO-FISSION OF URANIUM NUCLEI WITH EMISSION OF LIGHT, LONG RANGE PARTICLES. B. P. Bannik and Yi. S. Ivanov. Translated by V. N. Rimskeykorsakoff from *Doklady Akad. Nauk. S.S.S.R.*, 103, 997-9(1955). 7p.

An abstract of this paper appears in *Nuclear Science Abstracts* as NSA 10-1073.

2902

ANGULAR DISTRIBUTION OF γ -RADIATION FROM $^9\text{Be}(\alpha, n\gamma)^{12}\text{C}$. N. W. Tanner (Cavendish Lab., Cambridge, England). *Proc. Phys. Soc. (London)* A68, 1195-7(1955) Dec. 1.

A 1 μm beam of He^+ ions was used to bombard a 1000 A Be target evaporated on to a copper backing. A NaI scintillation counter was used for counting the 4.43-Mev γ rays and was arranged to move around the Be target in a horizontal plane. Resulting data are tabulated, and the total cross section for the reaction was found to be 0.33 barn. (B.J.H.)

PARTICLE ACCELERATORS

2903 AERE-GP/R-1748

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

TRAJECTORIES IN THE ACCELERATING AND DRIFT SPACES OF A PROTON INJECTOR. N. M. King, L. C. W. Hobbs, and E. R. Harrison. Nov. 1955. 21p.

The dynamics of protons in the 500-kev injector for the Harwell Proton Linear Accelerator is outlined, taking account of space charge effects. The initial beam radius and divergence at the entrance to the accelerator tube, leading to the proper conditions at injection into the linear accelerator, have been calculated for different beam parameters, acceleration lengths, and drift lengths. It is concluded that the acceptance conditions of Tank I may be fulfilled, provided that no serious aberrations are present. (auth)

2904 PLAC-11

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

DESIGN OF THE R. F. RESONANT CAVITIES FOR ACCELERATION OF PROTONS FROM 50 TO 150 MEV. J. J. Wilkins. Sept. 1955. 8p.

Essential design parameters are given for r-f resonant cavities suitable for accelerating protons from 50 to 150 Mev. Details of dimensions, tolerances, field distributions, power losses and Q values are included. (auth)

2905

SCATTERING OF PROTONS THROUGH THE RESIDUAL GAS IN A SYNCHROTRON. I. ELASTIC SCATTERING.

Joseph Seiden. J. phys. radium **16**, 917-25(1955) Dec. (In French)

The protons accelerated in a synchrotron are subjected to numerous collisions with molecules of residual gas for the entire length of their range in the vacuum chamber. The multiple elastic scattering generates oscillations whose amplitudes are evaluated according to Molière's law. This amplitude is proportional to the square root of the gas pressure in the vacuum chamber and inversely proportional to the square roots of the injection energy and of the gain per revolution. The theory is applied to various synchrotrons in construction. Applied to the strong-focussing synchrotron project at M.I.T., it shows that the amplitudes generated by multiple scattering are, on an average, greater than the vertical half-width of the vacuum chamber. The proton losses by simple elastic scattering are calculated. They are proportional to the gas pressure and inversely proportional to the injection energy and to the energy gain per revolution. Six percent of the protons are lost by simple scattering in the operation of the Brookhaven cosmotron. Fourteen percent of the protons will be lost by simple scattering for the M.I.T. synchrotron. (tr-auth)

2906

REGENERATIVE BEAM EXTRACTION ON THE CHICAGO SYNCHROCYCLOTRON. A. V. Crewe and U. E. Kruse (Enrico Fermi Inst. for Nuclear Studies, Chicago). Rev. Sci. Instr. **27**, 5-8(1956) Jan.

The proton beam extraction system of the 450-Mev Chicago synchrocyclotron is described. The nonlinear theory of LeConteur has been applied and an external beam of 10^{11} protons/sec has been obtained. (auth)

2907

FAST TRIGGER CIRCUIT. William C. Davidon and Richard B. Frank (Institute for Nuclear Studies, Chicago). Rev. Sci. Instr. **27**, 15-16(1956) Jan.

A trigger circuit has been developed using a 6BQ7A receiving tube with a recovery time of $\sim 1.5 \times 10^{-7}$ sec and an input sensitivity of 0.17v. The circuit and test results are described. (auth)

RADIATION ABSORPTION AND SCATTERING

2908 AERE-Lib/Trans-610

ON THE THEORY OF A NON STEADY RADIATION FIELD. I. V. V. Sovolev. Translated by J. B. Sykes from Astron. Zhur. **29**, 406-17(1952). 14p.

The theory of non-steady processes of the diffusion of radiation, which may have applications in both astrophysics and physics, is considered. Equations for the diffusion of radiation in one direction are derived. Applications of the theory are indicated briefly. (B.J.H.)

2909

SMALL-ANGLE SCATTERING OF FAST POLARIZED NEUTRONS BY HEAVY NUCLEI. J. T. Sample (Univ. of British Columbia, Vancouver). Can. J. Phys. **34**, 36-42 (1956) Jan.

Detailed calculations have been carried out which indicate that the small-angle scattering of fast neutrons by Pb depends on the polarization, or spin orientation, of the neutrons. When the scattering of neutrons whose spin vectors point upward is observed in the horizontal plane, more neutrons should be found scattered to the right than

to the left. For completely polarized 3.1-Mev neutrons the theory predicts a maximum "right to left" intensity ratio of 14.5:1 at a scattering angle of 0.5° , the ratio decreasing to 1.6:1 at 5° , and approaching unity rapidly as the scattering angle increases. (auth)

2910

THE ANGULAR DISTRIBUTION OF α -PARTICLES FROM THE REACTION $^{19}\text{F}(\alpha)^{16}\text{O}^*(\pi)^{16}\text{O}$. Akira Isoya, Kazuo Goto, and Teruo Momota (Univ. of Tokyo). J. Phys. Soc. Japan **10**, 1022(1955) Nov.

Four G-M counters connected in parallel were used to measure the angular distribution of α particles from the reaction $\text{F}^{19}(\text{p},\alpha)\text{O}^{16}$. Van de Graaff protons were used for the experiment. The results are briefly discussed. (B.J.H.)

2911

GAMMA-RAY ATTENUATION. David G. Chappell (Knolls Atomic Power Lab., Schenectady, N. Y.). Nucleonics **14**, No. 1, 40-1(1956) Jan.

A graph of mass absorption coefficient, μ_m , as a function of atomic number is presented, and a nomogram is provided to convert μ_m to the linear absorption coefficient by multiplying by the density of the shield material. Relaxation length, shield attenuation factor, and shield thickness are included on the nomogram. (M.P.G.)

2912

POLARIZATION OF HIGH ENERGY PROTONS SCATTERED BY IRON. T. Eriksson (Univ. of Uppsala, Sweden). Nuovo cimento (10) **2**, 907-10(1955) Nov.

The polarization of protons scattered by iron is calculated at 90, 150, 225 and 400 Mev. The phases are calculated with the so called "optical model". A type and strength of the spin-orbit term similar to that used by E. Fermi is assumed. (auth)

2913

POLARIZATION OF HIGH ENERGY NUCLEONS SCATTERED BY NUCLEI. S. Köhler (Univ. of Uppsala, Sweden). Nuovo cimento (10) **2**, 911-16(1955) Nov.

Calculations have been made on the polarization of protons scattered by nuclei at high energies. With the spin-orbit coupling similar to that used by E. Fermi one appears to get good agreement with experiments at 135 Mev. At 90 Mev phase-shifts were, for comparison, calculated both in the W.K.B. and the Born approximations. An alternative derivation of the explicit formula for the polarization of neutrons first given by E. Fermi in the Born approximation is outlined briefly. (auth)

2914

A NEW MULTIPLE SCATTERING PARAMETER. H. J. Lipkin, S. Rosendorff, and G. Yekutieli (Weizmann Inst. of Science, Rehovoth, Israel). Nuovo cimento (10) **2**, 1015-28(1955) Nov.

A new parameter is proposed for the characterization of the multiple scattering observed in tracks of charged particles. This parameter is the mean value of the cosine of a constant times the projected scattering angle. The theoretical relation between the mean value of the cosine parameter and the momentum-velocity product $\beta\delta$ of the particle can be calculated analytically in a simple way. A theoretical dispersion is also calculable, thereby giving an estimate of the error. This is in contrast to the parameter usually used in track measurements; namely, the mean absolute value of the projected scattering angle where the

mean value calculation is complicated and the dispersion is excessively sensitive to the form of the scattering law at large angles. Theoretical results for the mean value and dispersion of the cosine parameter are given for two cases: 1) angles between successive tangents at intervals along the track; 2) angles between successive chords. The effect of the correlation between successive measurements is considered in the latter case. (auth)

2915

THE IONIZATION BY ELECTRONS OF THE EXCITED 2s AND 2p STATES OF ATOMIC HYDROGEN. P. Swan (Melbourne Univ., Australia). Proc. Phys. Soc. (London) **A68**, 1157-60(1955) Dec. 1.

The cross sections for ionization by electrons of H2s and H2p states have been evaluated in the energy range 5 to 100 ev. First order perturbation theory is employed, the ejected electron being described by a Coulomb wave function, and the bombarding electron by plane waves both before and after collision. The H2s cross sections are larger than the H2p values, but both are much greater than the cross section for ionization of the ground state H1s. The classical cross section formula agrees roughly with the H2p(m = ±1) results, but is considerably smaller than the H2p(m = 0) and H2s cross sections. (auth)

2916

ELASTIC SCATTERING OF GAMMA RAYS. J. R. Cook (Middlesex Hospital Medical School, London). Proc. Phys. Soc. (London) **A68**, 1170-6(1955) Dec. 1.

A number of discrepancies appear in the published values for the cross sections for the elastic scattering of high energy gamma rays. A direct method, using a scintillation spectrometer, has therefore been developed to measure the cross section for elastic scattering in terms of the Compton cross section. This has been done for energies of 0.411, 0.66, 1.17 Mev at an average scattering angle of approximately 80° in lead, tin, copper and mercury. The cross sections are in agreement with classical prediction in these elements for 0.411 and 0.66 Mev photons. The existence of Delbruck scattering is suggested in the case of 1.17 Mev scattering from lead. (auth)

2917

MUTIPLE SCATTERING IN A COULOMB FIELD IN VERY THIN LAYERS OF MATERIAL. A. S. Kompaneets (Moscow Inst. of Engineering Physics). Soviet Phys. JETP **1**, 262-4(1955) Sept. (In English). Zhur. Eksptl. i Teoret. Fiz. **28**, 308-11(1955) Mar. (In Russian)

Data about multiple Coulomb scattering in foils of optical thickness 1 and 3 are given. The relative role of single and triple scattering for different angles of deflection is clarified. In an appendix, a model of Coulomb scattering through small angles is considered. (auth)

Refer also to abstracts 2855, 2871, 2946, 2952, and 2955.

RADIATION EFFECTS

2918 WAPD-79

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

WAPD-1 EXPERIMENTS IN THE MATERIALS TESTING REACTOR. I. GAMMA HEATING WAPD-1-1. Warren F. Witzig. Mar. 1953. Decl. Nov. 2, 1955. 31p. Contract AT-11-1-GEN-14.

A maximum value of about 12.5 watts/gm of gamma heat in aluminum has been measured in the L-42 location at the reactor centerline. At steady state conditions the gamma heat effect was found to be approximately linear with power level at reactor startup. It was found that the gamma heat in the L-42 location is very dependent upon vertical position. This spatial effect coupled with a somewhat higher value of gamma heat than was previously expected, makes it more difficult to establish a constant uniform specimen temperature within the active lattice. Such a temperature condition is necessary for creep experiments, fuel element dimensional stability experiments and electrical resistivity experiments. Additional tests are underway in the MTR using recirculating helium in an attempt to produce the desired temperature conditions. The feasibility of conducting experiments in the active lattice of the MTR using bottom entry has been demonstrated by the gamma heat experiment. In this experiment, chromel alumel thermocouples have been exposed to 1425 megawatt days of irradiation without permanent damage within a precision of ±0.2°C. (auth)

2919

EFFECT OF NEUTRON IRRADIATION ON THE PRECIPITATION-HARDENING REACTION IN ALLOYS CONTAINING BERYLLIUM. R. H. Kernohan, D. S. Billington, and A. B. Lewis (Oak Ridge National Lab., Tenn.) J. Appl. Phys. **27**, 40-2(1956) Jan.

Neutron irradiation effects in the precipitation hardening alloy, nickel-beryllium, were measured using the ferromagnetic Curie temperature as an index of the amount of precipitate formed. Effects found previously in a similar precipitation hardening alloy, copper-beryllium, were not found upon irradiation at approximately room temperature. However, an irradiation for an integrated fast flux of 4×10^{17} n/cm² at a temperature of 300°C showed that 1.3 atomic percent more beryllium in the form of the compound Ni-Be precipitated from a supersaturated solid solution than from a similar specimen held at 300°C but not irradiated. (auth)

2920

ELECTRIC STRENGTH OF IRRADIATED POLYTHENE. K. H. Stark and C. G. Garton (Electrical Research Assoc., Perivale, Middlesex, England.) Nature **176**, 1225-6(1955) Dec. 24.

The effects of electron irradiation on the electric strength and elasticity of polythene were investigated. The apparent electric strength observed at temperatures above 80°C corresponds to a breakdown in the material attributed to mechanical deformation. (C.W.H.)

2921

HOW TO CALCULATE GAMMA RADIATION INDUCED IN REACTOR MATERIALS. C. D. Bopp and O. Sisman (Oak Ridge National Lab., Tenn.). Nucleonics **14**, No. 1, 46-50 (1956) Jan.

Data are presented on the γ activity induced in reactor materials such as alloys of Fe, Ni, and Al, stainless steels, concretes, and graphite irradiated in the ORNL Graphite Reactor. The component activities of the materials are identified. A method is given for estimating activities induced in materials exposed under similar conditions. (M.P.G.)

2922

IRRADIATING SMALLER PIECES GIVES STRONGER Co⁶⁰ SOURCES. Lawrence H. Lanzl and Lester S. Skaggs

(Argonne Cancer Research Hospital, Chicago). Nucleonics **14**, No. 1, 66-7(1956) Jan.

Large specimens do not become as radioactive in a reactor as several smaller specimens with the same total volume. Large specimens depress the reactor flux more, and the central portion of a large absorber is exposed to fewer neutrons because of high peripheral absorption. Data are presented from experiments on irradiating samples of various configurations and number of component parts but with the same total volume. (M.P.G.)

2923

FAST-NEUTRON BOMBARDMENT OF GaSb. J. W. Cleland and J. H. Crawford, Jr. (Oak Ridge National Lab., Tenn.). Phys. Rev. **100**, 1614-18(1955) Dec. 19.

Fast-neutron irradiation decreases the carrier concentration of polycrystalline samples of n - and p -type GaSb, indicating the production of low-lying traps. Vacuum heat treatment evidently removes such traps but also introduces additional acceptors, indicating a different rate of annealing for bombardment produced interstitial and vacancy atoms. Irradiation and heat treatment of n -type GaSb therefore results in the production of material of lower carrier concentration and reirradiation results in the conversion to p -type material. Repeated irradiations followed by heat treatments, however, do not reduce the net effective concentration of electrons in n -type material below $\sim 5 \times 10^{17} \text{ cm}^{-3}$. The mobility of all samples is decreased by bombardment. Heat treatment subsequent to irradiation increases the mobility of n -type material but decreases the mobility of p -type samples still further below the decrease produced by bombardment. Low-temperature (-125°C) irradiation and subsequent warm-up and cool-down curves indicate the presence of defects of low thermal stability. No evidence was obtained for regions of low resistivity resulting from superlattice disordering as a result of quenching as might be expected from the thermal spike picture. The type and position of fast-neutron-introduced lattice defects is discussed with relation to previous models for Ge and InSb. (auth)

2924

IONIZATION BY ALPHA PARTICLES IN MIXTURES OF GASES. William P. Jesse and John Sadauskis (Argonne National Lab., Lemont, Ill.). Phys. Rev. **100**, 1755-62 (1955) Dec. 15.

The presence of minute impurities greatly increase the ionization produced by Po alpha particles in helium. Systematic studies of this effect show an increase in ionization up to 40% for approximately 0.1% of argon. Similar results have been obtained with CO_2 , Kr, Xe, H_2 , N_2 , and C_2H_4 as the contaminant. Preliminary experiments with mercury vapor in helium confirm the large effect already reported by others. A similar increase in ionization in pure argon is obtained by the addition of C_2H_2 or C_2H_4 . These increases in ionization seem to be caused by the production of ions, when metastable atoms in the parent gas undergo collisions with molecules of the impurity. In mixtures of H_2 , N_2 , or A with helium, the excess in ionization is observed to decrease by a few percent as the pressure of the gas mixture is increased from 48 to 119 cm of mercury. For no other contaminant gases tested thus far in helium is such a pressure change in ionization observed. (auth)

2925

RADIATION-INDUCED AMORPHISM IN DIAMOND. Paul W. Levy and Otto F. Kammerer (Brookhaven National Lab.,

Upton, N. Y.). Phys. Rev. **100**, 1787-8(1955) Dec. 15.

In order to investigate the possibility that one might find evidence for amorphous carbon or graphite in diamond severely damaged by irradiation, 270-mesh diamond was annealed at 500°C for 2 hrs and then irradiated in the MTR. X-ray-diffraction patterns of both the irradiated and a control sample are shown. The pattern from the irradiated diamond shows the continuous, almost structureless pattern of an amorphous material. (B.J.H.)

Refer also to abstract 2649.

RADIOACTIVITY

2926 AERE-C/R-1502

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DETERMINATION OF RADIOACTIVITY DUE TO FISSION PRODUCT NIOBIUM. A. J. Fudge. Dec. 8, 1954. 11p.

A method is described for the separation of fission product Nb by the use of a paper chromatographic procedure. Carrier Nb is added to a fluoride solution of the fission products and development of the chromatogram is carried out with 20% hydrofluoric acid/methyl ethyl ketone. The Nb area on the paper after visual detection with tannin, is counted using a γ scintillation counter, against Nb^{95} standards. Up to twenty samples can be analyzed simultaneously, the overall time for the method being about two and a half hours. The results of parallel analyses carried out by this procedure and by the D. At En Method 1013 are in agreement to within 3%. The coefficient of variation of the results obtained by the chromatographic method was 3% for fission product solutions and 2% for standard niobium solutions. (auth)

2927

THE DECAY OF Re^{186} AND Re^{188} . M. W. Johns, C. C. McMullen, I. R. Williams, and S. V. Nablo (McMaster Univ., Hamilton, Ontario). Can. J. Phys. **34**, 69-82(1956) Jan.

The energies and intensities of 13 γ rays in Re^{188} have been measured by studying their external conversion spectra with a high resolution β -ray spectrometer. An analysis of the β -ray spectrum reveals groups with end points 2116 kev (79%) and 1961 kev (20%), and several low energy groups whose total intensity is of the order of 1%. The observed data can be consistently accounted for in terms of a decay scheme involving the following levels of Os^{188} : 0.0, 155.0, 633, 1086, 1306, 1461, 1765, 1941, and 1958 kev. This scheme is firmly supported by coincidence measurements. The spins of the first three levels listed are $0+$, $2+$, and $2+$ and that of the 1461 kev. level is probably $0+$. The decay of Re^{186} is accompanied by gamma rays of the following energies and quantum intensities: 122.9 kev (0.6%), 137.2 kev (10%), 630.8 kev (0.024%), and 768.2 kev (0.024%). These values are in good agreement with those quoted in the literature, except for the intensities of the last two radiations. (auth)

2928

MEASUREMENT OF THE MEAN LIFE OF THE SECOND EXCITED STATE OF F^{19} . Marcel Flehrer, Pierre Lehmann, Antoine Leveque, and Robert Pick. Compt. rend. **241**, 1746-8(1955) Dec. 14. (In French)

The mean life of the 197-kev excited state of F^{19} was

measured and found to be $(1.23 \pm 0.07) \times 10^{-7}$ sec., in agreement with previous, less precise results. (tr-auth)

2929

LONG RANGE PARTICLES EMITTED BY A Pu^{239} SOURCE.

Marie Ader. *Compt. rend.* **241**, 1748-9(1955) Dec. 14.

(In French)

Nuclear emulsions were exposed to a source of Pu^{239} and were then examined for tracks of length greater than 50μ . The general characteristics of these longer tracks are discussed briefly. (B.J.H.)

2930

DETERMINATION OF LOW CONTENT HAFNIUM IN ZIRCONIUM BY EMISSION OF X FLUORESCENCE. Jacques Despujols and Daniel Lumbroso (Laboratoire de Chimie Physique de la Faculté des Sciences de Paris). *J. Chim. phys.* **53**, 108-10(1956) Jan. (In French)

The intensity of the $\text{L}\beta_2$ x-ray of hafnium was measured by using a curved crystal spectrometer and a Geiger counter. A second counter was used as a monitor in order to increase the precision. One can thus determine some hundredths of a percent of hafnium with an absolute error of the order of 1.5×10^{-4} . (tr-auth)

2931

RESEARCH ON THE DOUBLE β RADIOACTIVITY OF Cd^{116} .

Jean-Francois Detoeuf and Raymond Moch (College de France, Paris). *J. phys. radium* **16**, 897-901(1955) Dec. (In French)

Measurements were made in an attempt to prove that a possible double radioactivity of Cd^{116} agrees with Furry's scheme. The method used, that of coincidences between scintillation counters placed on each side of the source, permitted the measurement of the energy of each of the particles emitted. A lower limit of 0.6×10^{17} years was found for the half-life, which neither proves or disproves the hypothesis of a phenomenon without neutrino emission. Comparison with other known results shows that the problem is nearly complete and that new experiments are desirable. (tr-auth)

2932

ON THE DECAY OF $^{51}_{24}\text{Cr}$. A. Bisi, E. Germagnoli, and L. Zappa (Istituto di Fisica Sperimentale del Politecnico, Milan, Italy). *Nuovo cimento* (10) **2**, 1052-7(1955) Nov.

From the energy spectrum of γ rays emitted in the decay $\text{Cr}^{51} \rightarrow \text{V}^{51}$, a revised scheme of the levels of V^{51} is deduced. A direct determination of the energy involved in this transition is described. (auth)

2933

BETA-GAMMA COINCIDENCE SPECTRUM OF THE UX-COMPLEX. E. F. De Hann (Natuurkund Lab., N. V. Philips' Gloeilampenfabrieken, Eindhoven, Netherlands). G. J. Sizoo, and P. Kramer (Vrije Univ., Amsterdam, Netherlands). *Physica* **21**, 803-17(1955) Oct.

From coincidence measurements, made in a magnetic coincidence spectrometer, the maximum energies of the partial beta-spectra of UX_1 and UX_2 were found to be about 100 kev (UX_1), 600 kev and 1500 kev (UX_2), while furthermore some conversion lines due to gamma-gamma cascades have been obtained. Possible decay schemes are discussed. (auth)

2934

CIRCULAR POLARIZATION OF GAMMA RADIATION EMITTED BY ORIENTED ^{60}Co NUCLEI. J. C. Wheatley, W. J. Huiskamp, A. N. Diddens, M. J. Steenland, and H. A.

Tolhoek (Kamerlingh Onnes Lab., Leiden, Netherlands). *Physica* **21**, 841-59(1955) Nov.

An experiment is described in which the circular polarization of the gamma radiation emitted by polarized Co^{60} nuclei was measured. The detection of the circular polarization was performed by measuring the change of the Compton scattering of the gamma radiation from magnetized iron when the direction of the polarization of the nuclei is reversed. The nuclei are polarized in single crystals of $2\text{Ce}(\text{NO}_3)_3 \cdot 3\text{Mg}(\text{NO}_3)_2 \cdot 24\text{H}_2\text{O}$ containing about $110\mu\text{c}$ Co^{60} , which are cooled by adiabatic demagnetization from a field of about 22000 ϕ and a temperature of about 1°K . A residual field of 280 ϕ along the trigonal axis causes a considerable degree of polarization of the nuclei, resulting in a degree of circular polarization as high as 75% at the lowest temperature, 0.006°K . The observed fractional change in counting rate E of the scattered gamma radiation upon changing the direction of the polarization of the nuclei relative to the direction of magnetization of the scattering iron amounted to at most 3%. The effect was clearly observable to temperatures up to 0.05°K . From the sign of the effect it can be concluded that the magnetic moment of Co^{60} is positive. The dependence of the effect on the temperature can be calculated theoretically starting from data on the hfs in the crystal. When approximating this dependence by $E = a/T$ (in the region $1/T \leq 60$) an average experimental value $a_{\text{exp}} = 0.045 (\pm 10\%)$ and an average theoretical value $a_{\text{theor}} = 0.0445$ were found. For lower temperatures ($1/T > 60$) there seems to be a significant difference between the experimental and theoretical values of E , which may be due to uncertainties in the knowledge of the hyperfine structure. (auth)

2935

RADIOACTIVE DECAY OF ^{57}Co . W. C. Middelkoop, A. Heyligers, L. H. Th. Rietjens, H. J. Van den Bold, and P. M. Endt (Technische Hogeschool, Delft, and Rijksuniversiteit, Utrecht, Netherlands). *Physica* **21**, 897-8(1955) Nov.

A search for a 0.51-Mev annihilation γ ray for Co^{57} revealed that it occurred from the presence of Co^{56} contamination, with an upper limit of 0.1% per disintegration set for the occurrence of positrons in Co^{57} decay. It was also established in the investigation that in the 14-123 kev γ cascade the 14-kev γ is delayed relative to the 123-kev γ . (L.M.T.)

2936

THE HALF-LIFE OF THE FIRST EXCITED STATE OF ^{111}Cd . L. H. Th. Rietjens, H. J. Van den Bold (Rijksuniversiteit, Utrecht, Netherlands) and A. Heyligers (Technische Hogeschool, Delft, Netherlands). *Physica* **21**, 899-900(1955) Nov.

A value of $(8.5 \pm 0.2) \times 10^{-8}$ sec was found for the half life of the 247-kev isomer of Cd^{111} , in agreement with previous results. (L.M.T.)

2937

Tc K X-RAY SPECTRUM. George L. Rogosa and William F. Peed (Oak Ridge National Lab., Tenn.). *Phys. Rev.* **100**, 1763(1955) Dec. 15.

Fluorescent x-radiation from 100 mg of $\text{KTC}^{99}\text{O}_4$ was analyzed with a Cauchois-type curved-crystal spectrometer and four K-series x-ray lines of Tc were recorded. The wavelengths, accurate to within 0.1 xu, are: Ka_2 , 677.90; Ka_1 , 673.57; $\text{K}\beta_{1,3}$, 600.20; $\text{K}\beta_{2,4}$, 588.99; all wavelengths in xu. (auth)

2938

A SEARCH FOR LOW INTENSITY GAMMA RAYS IN THE ThC' AND ThC'' D TRANSITIONS. D. G. E. Martin and G. Parry (Univ. of Liverpool, England). *Proc. Phys. Soc. (London)* **A68**, 1177-83(1955) Dec. 1.

A 180° spectrometer has been used to study the Compton electrons ejected from polythene radiators by the gamma rays from a radio-thorium source, in an attempt to detect gamma rays of low intensity between the energies of 1 Mev and 3.5 Mev. The only gamma rays detected in this region were a gamma ray at 1.62 Mev and the well-known 2.62-Mev ray, the intensity of the 1.62-Mev ray being about 3.5% of the 2.62-Mev ray. Upper limits are estimated for the intensities of gamma rays which have been previously reported by some workers. A possible decay scheme for ThC is discussed. (auth)

2939

ON THE PROBLEM OF THE DECAY OF Ta^{180} . P. Eberhardt, J. Geiss, and C. Lang (Max Planck Inst. for Chemistry, Mainz, Germany). *Z. Naturforsch.* **10a**, 796(1955) Sept.-Oct. (In German)

2940

ON THE DECAY SCHEME OF I^{128} . Th. Stribel (Max Planck Inst. of the Physics of the Stratosphere, Hechingen, Germany). *Z. Naturforsch.* **10a**, 797(1955) Sept.-Oct. (In German)

2941

ON THE γ RAYS OF Te^{129} . Th. Stribel (Max Planck Inst. of the Physics of the Stratosphere, Hechingen, Germany). *Z. Naturforsch.* **10a**, 797-8(1955) Sept.-Oct. (In German)

RARE EARTHS AND RARE-EARTH COMPOUNDS

2942

MAGNETIC PROPERTIES OF ERBIUM METAL. J. F. Elliott, S. Legvold, and F. H. Spedding (Iowa State Coll., Ames). *Phys. Rev.* **100**, 1595-6(1955) Dec. 15.

Measurements of the magnetic moment of erbium metal in the temperature range from 20.4°K to 90°K are reported. The initial susceptibility shows a maximum at 78°K , and the metal appears to become ferromagnetic near 20°K . (auth)

SHIELDING

Refer to abstract 2911.

SPECTROSCOPY

2943 AERE-Lib/Trans-625

FINE STRUCTURE OF THE PARAMAGNETIC RESONANCE SPECTRUM OF THE Cr^{+++} ION IN CHROMIUM CORUNDUM. A. A. Manenkov and A. M. Prokhorov. Translated by J. B. Sykes from *Zhur. Eksptl'. i Teoret. Fiz.* **28**, 762(1955). 3p.

The paramagnetic resonance in the solid solution $\text{Al}_2\text{O}_3\text{-Cr}_2\text{O}_3$, with a Cr concentration of 0.5%, was investigated at room temperature. At the frequency 8960 MHz, two observed lines are due to magnetic dipole transitions $M = \frac{3}{2} \leftrightarrow \frac{1}{2}$, and one to the transition $M = \frac{1}{2} \leftrightarrow -\frac{1}{2}$; at 11,970 MHz, observed lines are due to the transitions, $M = \frac{3}{2} \leftrightarrow \frac{1}{2}$, $M = \frac{1}{2} \leftrightarrow -\frac{1}{2}$, and $M = -\frac{3}{2} \leftrightarrow -\frac{1}{2}$. (C.W.H.)

2944

THREE PROTOTYPES FOR THE CATHODO-LUMINESCENCE SPECTRA OF PRASEODYMIUM IN VARIOUS FORMS OF ALUMINA. Eiichi Iwase, Seijiro Nishiyama, and Toshiaki Isono (Institute of Scientific Researches, Tokyo). *Bull. Chem. Soc. Japan* **28**, 345-7(1955) July.

Almost all the cathodo-luminescence spectra given by the various preparations of the praseodymium-bearing alumina can be regarded as belonging to either one of the three prototypes (I, II and III) or their combinations. The occurrence of these three fundamental spectral types for the praseodymium-luminescence may closely be related with the three ways for the reciprocal arrangements of oxygen and aluminium in the configuration of alumina. The prototype II of the praseodymium-luminescence spectrum is obtained for the alumina with the oxygen network of hexagonal close-packing, namely the α -modification. The alumina with the oxygen network of cubic close-packing, shows either the luminescence prototype I or III, depending upon the location of aluminium ions. The prototype I is seen in the γ -modification of alumina, where the aluminium ions are statistically distributed evenly throughout the two sorts of interstices of the oxygen network, namely octahedral and tetrahedral interstices, while the luminescence prototype III is yielded with the κ -modification of alumina, in which the aluminium ions take their seats in the tetrahedral rather than in the octahedral interstices. (auth)

2945

THE ROLE OF THE 1.30 MEV GAMMA-RAY IN THE DECAY OF In^{114} . M. W. Johns, I. R. Williams, and D. E. Brodie (McMaster Univ., Hamilton, Ontario). *Can. J. Phys.* **34**, 147-9(1956) Jan.

Indications that the 556-keV γ ray of In^{114} was in coincidence with the 722- and 1300-keV γ rays have been investigated. The results indicate a coincidence of the 556- and 722-keV γ rays, but not the 556- and 1300-keV γ rays. A proposed decay scheme is presented. (D.E.B.)

2946

SPECTRAL EFFECTS ON PHOTOLUMINESCENCE EMISSION OF ALKALINE IODIDES ACTIVATED BY THALLIUM. Z. L. Morgenshtern (Lebedev Inst. of Physics). *Doklady Akad. Nauk S.S.S.R.* **105**, 250-2(1955) Nov. 11. (In Russian)

Data on the effects of the light incident wave length on the luminescence emission were correlated to the data of absorption of the activated and non-activated KI-Tl, NaI-Tl and CsI-Tl monocrystals. (R.V.J.)

2947

INFRARED SPECTRUM OF HYDROGEN SULFIDE FROM 2200-2800 cm^{-1} . Harry C. Allen, Jr., L. R. Blaine, and Earle K. Plyer (National Bureau of Standards, Washington, D. C.). *J. Chem. Phys.* **24**, 35-8(1956) Jan.

The absorption of H_2S from 2200 to 2800 cm^{-1} has been observed under high resolution. It can be accounted for by two bands having excited states $(n_1, n_2, n_3) = (0, 2, 0)$, and $(1, 0, 0)$. A novel feature of this analysis is the assignment of the strong absorption in the high-frequency portion of this region as arising from the transition $(0, 0, 0) \rightarrow (1, 0, 0)$. The parameters giving the best fits to the observed absorption are:

	A*	B*	C*	ν_0
(0, 2, 0)	11.099	9.443	4.610	2353.93 cm^{-1}
(1, 0, 0)	10.249	8.831	4.663	2614.56 cm^{-1}

It was not possible to assign enough transitions in the (0,0,1) band to determine a unique set of parameters. (auth)

2948

VIBRATIONAL SPECTRUM OF CF_3CN . Walter F. Edgell and Ralph M. Potter (Purdue Univ., Lafayette, Ind.). J. Chem. Phys. 24, 80-5(1956) Jan.

The Raman spectrum of liquid CF_3CN has been obtained at -100°C . The infrared spectrum of the gas at room temperature has been obtained from 2 to 38μ . The analysis of these data yield the fundamentals, which are used to interpret the overtone and combination bands. A qualitative discussion of the character of the vibrations, which is based upon comparison with other molecules of the CF_3X type, is given in terms of orthogonal characteristic vibrations. The results of a normal coordinate analysis are included. (auth)

THEORETICAL PHYSICS

2949 UCRL-Trans-253

ZERO EQUALITY OF RE-NORMALIZED CHARGE IN QUANTUM ELECTRODYNAMICS. I. Pomeranchuk. Translated by S. Shewchuck from Doklady Akad. Nauk S.S.S.R. 103, 1005-8(1955). 6p.

2950

ASYMPTOTIC EXPANSIONS OF PHASE SHIFTS AT HIGH ENERGIES. M. Verde (Institute for Advanced Study, Princeton, N. J.). Nuovo cimento (10) 2, 1001-14 (1955) Nov.

Asymptotic expansions of the phase shifts for large values of the momentum, considering central static potentials only are given. For non-singular potentials a recurrence relation which allows the calculation of terms of every order in $1/p$ is established. For potentials which are singular as $1/r$ at the origin, or regular for all angular momenta, the expansions are explicitly written neglecting terms of the order $1/p^5$. (auth)

2951

THE α -PARTICLE MODEL OF ^{20}Ne . A. Gamba and A. Moncassoli (Istituto di Fisica dell'Università, Turin, Italy). Nuovo cimento (10) 2, 1119-20(1955) Nov.

A slightly modified version of the α -particle nuclear model was used to predict spin, parities, and energies of the excited states of Ne^{20} . For this modification, no assumption was made concerning the equality of "bond distances" between α particles. The theoretical values of energies of the excited states are in close agreement with experimental values. It is suggested that spins and parities of the higher excited states be measured in order to give a further check for this theory. (B.J.H.)

2952

ON THE SCATTERING OF NEUTRONS BY ALPHA PARTICLES. E. Clementel and C. Villi (Istituti di Fisica dell'Università di Padova and Trieste). Nuovo cimento (10) 2, 1121-6(1955) Nov.

A theoretical study is made of the phenomenological phase shifts of neutrons elastically scattered by α particles in order to provide information on the energy of He^5 . Resultant phase shifts are tabulated. (B.J.H.)

2953

INTER-ATOMIC FORCE LAW AND EQUATION OF STATE OF SOLIDS. B. Dayal (Banaras Hindu Univ., India and Birkbeck Coll., London) and R. S. Sharma (Banaras Hindu

Univ., India and Royal Holloway Coll., London). Proc. Phys. Soc. (London) B68, 1049-53(1955) Dec. 1.

The pressure of a solid has been divided into two terms p_1 and p_2 , of which the first is the static part due to a non-vibrating lattice at $T = 0$, and the second arises from the thermal vibrations. For all volumes measured at zero pressure the two are equal and opposite to each other. The static pressures of eight solid elements, aluminium, copper, silver, gold, lead, platinum, tungsten and molybdenum, have been obtained from their thermal pressures $\gamma E/V$ by the use of the above condition. The average Grüneisen constant γ has been calculated in the usual way from the thermal expansion and the specific heat data. These static pressures have been compared with the derivatives of the potential energy as derived from the inter-atomic potential used earlier by Fürth, and a very close agreement has been observed between them. (auth)

2954

CONNECTION OF THE STRONG COUPLING THEORY WITH THE WEAK COUPLING THEORY IN THE BOUND MESON PROBLEM. THE SYMMETRICAL SCALAR THEORY. Smio Tani (Univ. of Education, Tokyo) and Wataro Watari (Kyoto Univ., Japan). Progr. Theoret. Phys. (Japan) 14, 243-59(1955) Sept.

The bound meson problem is studied in the p-representation of meson oscillators, where p is the canonical momentum. These ideas may be applied to other problems than the symmetrical scalar one. The domain of p is divided into inner and outer regions. It is proved by application of canonical transformations that such a process is natural. In the inner region, the precession of the τ -spin is dominant, which takes place as bound mesons are virtually emitted or absorbed. On the other hand, in the outer region the coupling between the radial mode of the meson with the τ -spin is primarily important. Since all relevant quantities appear as functions of $V|p|$, (V is the coupling constant), the characteristics of regions may be discussed independently of V , if we choose $1/V$ as the unit of length of p . Then, in this scale, it is seen that the wave functions of low-lying states are damped when the magnitude of $|p|$ is larger than V . By means of these considerations, the characteristics of the problem can be understood for all ranges of V in a unified fashion. In a weak coupling case, the inner region is the only one to be taken into account, while the most noticeable features of a strong coupling case come from the outer region, to which the major part of a wave function belongs in this case. It is noticeable that the inner region is, however, essential to give finer details of a strong coupling case, which are of higher order in $1/V^2$. With these qualitative prospects in mind, a new approach is used to improve the results worked out by Sawada. However, ability to treat a complicated form of operators is at present so limited that the results are not yet satisfactory. Future improvements are discussed. (auth)

2955

THE CLOUDY CRYSTAL BALL MODEL FOR 14 MEV NEUTRON REACTIONS. Mitsuji Kawai, Haruo Ui (Univ. of Tokyo), and Masayuki Nagasaki (Tokyo Univ. of Education). Progr. Theoret. Phys. (Japan) 14, 263-5(1955) Sept.

An attempt is made to account for the observed behavior of 14-Mev neutron scattering by means of the cloudy crystal ball model. The results of calculations are compared graphically with the experimental value. Qualitative-

ly, calculated quantities are somewhat higher than the corresponding experimental values. (B.J.H.)

2956

THE ABSORPTION AND EMISSION OF X-RAYS IN FERROMAGNETIC METALS. A. V. Sokolov (Academy of Sciences, U.S.S.R.). *Soviet Phys. JETP* **1**, 333-5(1955) Sept. (In English). *Zhur. Eksptl.' i Teoret. Fiz.* **28**, 326-9(1955) Mar. (In Russian)

The problem of absorption and emission of x-rays by a ferromagnetic substance is examined in the framework of interaction of the inner and outer electrons. (auth)

2957

THE "EQUILIBRIUM" ENERGY SPECTRUM OF CASCADES OF PHOTONS. P. S. Isaev (P. N. Lebedev Inst. of Physics). *Soviet Phys. JETP* **1**, 379-80(1955) Sept. (In English). *Zhur. Eksptl.' i Teoret. Fiz.* **28**, 374-6(1955) Mar. (In Russian)

The equilibrium energy spectrum of photons generated in cascading electromagnetic processes is calculated, taking into account radiation damping, pair creation, ionization losses, and the Compton effect. (B.J.H.)

2958

THE GRAVITATIONAL SELF ENERGY OF PARTICLES IN THE CLASSICAL FIELD THEORIES. A. A. Borgardt (Dnepropetrovsk State Univ.). *Soviet Phys. JETP* **1**, 380-1(1955) Sept. (In English). *Zhur. Eksptl.' i Teoret. Fiz.* **28**, 377(1955) Mar. (In Russian)

2959

ON PHYSICAL INTERPRETATION OF De BROGLIE EQUATIONS. I. I. Kobozev. (Moscow Lomonosov State Univ.). *Zhur. Fiz. Khim.* **29**, 2007-17(1955) Nov. (In Russian)

A detailed investigation of basic quantum mechanics correlations—De Broglie equations—permit an objective approach to the physical picture of quantum particle behavior on the temporary boundary layer and leads to the discovery of some means for physical explanations of quantum effects. The behavior of free particles with rest mass, which for convenience are called heavy particles, are used as the main subject of the study. The developed conception of temporary oscillation of heavy particles in the τ layer gives the physical explanation of certain basic quantum properties. Nevertheless, many other important effects, as for instance, the abnormally large active cross sections are still beyond the physical explanations and require a much more accurate definition of the temporary oscillation of particles in the τ layer and of the physical properties of this layer. The developed concepts are not yet conclusive and are only meant to be used for further studies of quantum-mechanical processes based on the characteristic particle oscillation or quantum time. (R.V.J.)

2960

ON CONVERSION TO ZERO OF RENORMALIZED MESON CHARGE IN PSEUDOSCALAR THEORY WITH PSEUDOSCALAR COUPLING. I. Pomeranchuk. *Doklady Akad. Nauk S.S.S.R.* **105**, 461-4(1955) Nov. 21. (In Russian)

A detailed investigation of properties of G, D, and F with an arbitrary g^2 is given. The symbols coincide with the symbols of the previous work by the same author and the calculations are based on techniques of A. A. Abrikosov and I. M. Khalatnikov (*Doklady Akad. Nauk*, **103**, 993(1955)). The recent calculations of K. A. Ter Martirosyan et al, after detailed correlation of diagrams of meson scattering

by mesons proved that scattering of mesons by mesons does not change the conclusion that $g^2 = 0$. (R.V.J.)

2961

DIFFUSION OF LIKE PARTICLES ACROSS A MAGNETIC FIELD. Albert Simon (Oak Ridge National Lab., Tenn.). *Phys. Rev.* **100**, 1557-9(1955) Dec. 15.

It is shown that the diffusion rate across a magnetic field due to collision of like charged particles is derivable from the macroscopic equations of the plasma. However, it is necessary to include the off-diagonal terms in the stress tensor. The resultant diffusion rate does not obey Fick's law and is proportional to the inverse fourth power of magnetic field strength. This diffusion rate is usually smaller than that due to unlike particle collisions, but may sometimes dominate. (auth)

2962

KINETICS OF PROCESSES DISTRIBUTED IN ACTIVATION ENERGY. W. Primak (Argonne National Lab., Lemont, Ill.). *Phys. Rev.* **100**, 1677-89(1955) Dec. 15.

The kinetic behavior of systems in which processes occur which are distributed over a range of activation energies is considered. The effects produced by the initial distribution, the order of reaction, and the frequency factor are discussed. Imaginary and actual experimental situations are used to illustrate the large errors which can result when the distribution of the processes in activation energy is neglected. Some of the complications which can result from successive reactions and varying frequency factors are mentioned. (auth)

2963

THE SELF DISPLACEMENT EFFECT OF ELECTRONS. Rudolf Haag (Univ. of Munich, Germany). *Z. Naturforsch.* **10a**, 752-61(1955) Sept.-Oct. (In German)

A portion of the difficulties of the quantum field theory is due to a characteristic difference between mechanics and field theory which can be designated by the key word "self displacement effect". The problem exists in classical physics as well as in quantum physics. It will be shown here that for the self displacement effect of the electron and the electromagnetic field in classical physics, it is effectively canceled out in Dirac's theory, while the generalizations suggested by Eliezer are not acceptable. By the conception of Dirac's theory treated here, the paradoxes of the self acceleration will be justified by the hypotheses, so that Dirac's limiting requirements do not appear as an artificial secondary condition, but as an essential part of the equation of motion. The theory has therefore no "local" character, although the electron in a certain respect will be assumed to be localized. Existence and equivalence of the solution is assured for a wide area of initial conditions; the difficulties exist for very strong and rapidly varying fields. The relationship of Dirac's theory to conventional electrodynamics is discussed. (tr-auth)

TRACER APPLICATIONS

Refer to abstract 2769.

URANIUM AND URANIUM COMPOUNDS

2964 AECU-3141

Case Inst. of Tech., Cleveland. Nuclear Physics Lab. ANGULAR DISTRIBUTION OF FRAGMENTS FROM THE

PHOTOFISSION OF U^{238} . Technical Report No. 24. Z. L. Reineks, J. D. Finegan, and R. S. Shankland. [1955?]. 23p. Contract AT-11-1-gen-16. \$4.80(ph OTS) \$2.70 (mf OTS).

Ilford D1 and Eastman NTC nuclear emulsions were loaded with a solution of uranium acetate and then exposed to the x-ray beam of the Case betatron operated at 18 Mev. The developed plates were searched with a Zeiss type microscope. A total number of 1062 fission tracks were measured and analyzed, and the angular distribution of the fission fragments in the c.m. system were obtained. The angular distribution was fitted by the method of least squares to a function of the form $F(\theta) = a + b\sin^2\theta + c\sin^2 2\theta$, where $b\sin^2\theta$ is the dipole distribution, and $c\sin^2 2\theta$ is the quadrupole distribution. The least squares solution gave the following ratios: $b/a = -0.0097$ and $c/a = 0.0896$. The negligible dipole component found in the track distribution is in agreement with other experiments at these energies. The quadrupole coefficient has not hitherto been reported. Such a quadrupole term is to be expected when the wave length of the gamma rays is

comparable to the nuclear diameter, and probably results from direct electromagnetic interaction between photons and the nuclear proton distribution. (auth)

2965 MTA-36

California Research and Development Co. Livermore Research Lab., Livermore, Calif.

ON THE DIMENSIONAL INSTABILITY OF URANIUM AND OF CLAD PLATES SUBJECTED TO THERMAL CYCLING.

M. Bettman, G. W. Brown, and J. P. Frankel. Dec. 1953. Decl. Sept. 29, 1955. 21p. Contract AT(11-1)-74.

The dimensional instability of α uranium subjected to thermal cycling is explained on the basis of creep and relaxation characteristics of the metal, in conjunction with the thermal anisotropy. No appeal is made to grain boundary relaxation processes. The theory enables a qualitative treatment of the effects of rates of heating and cooling and "hold times" on the amount of growth. These principles have also applied to the case of multimetallic sandwiches. (auth)

Refer also to abstract 2716.